Mapping the X-ray Sky with SRG: First Results from eROSITA and ART-XC

Report of Contributions

Contribution ID : 4   Type : **Oral Presentation**

eROSITA discovery of a new AGN state in 1H0707-495

Tuesday, 17 March 2020 17:45 (15)

One of the most prominent AGNs, the ultrasoft Narrow-Line Seyfert 1 Galaxy 1H0707-495, has been observed with eROSITA as one of the first CAL/PV observations on October 13, 2019 for about 60.000 seconds. 1H 0707-495 is a highly variable AGN, with a complex, steep X-ray spectrum, which has been the subject of intense study with XMM-Newton in the past. 1H0707-495 entered an historical low hard flux state, first detected with eROSITA, never seen before in the 20 years of XMM-Newton observations. In addition ultra-soft emission with a variability factor of about 100 has been detected for the first time in the eROSITA light curves. We discuss fast spectral transitions between the cool and a hot phase of the accretion flow in the very strong GR regime as a physical model for 1H0707-495, and provide tests on previously discussed models.

Presenter status

Senior eROSITA consortium member

Primary author(s) : Prof. BOLLER, Thomas (MPE); Prof. NANDRA, Kirpal (MPE Garching); Dr LIU, Teng (MPE Garching); MERLONI, Andrea; Dr DAUSER, Thomas (FAU Nürnberg); Dr RAU, Arne (MPE Garching); Dr BUCHNER, Johannes (MPE); Dr FREYBERG, Michael (MPE)

Presenter(s) : Prof. BOLLER, Thomas (MPE)

Session Classification : AGN physics, variability, clustering

Contribution ID : **9**   Type : **Poster**

X-ray emission from warm-hot intergalactic medium: the role of resonantly scattered cosmic X-ray background

We revisit calculations of the X-ray emission from warm-hot intergalactic medium (WHIM) with particular focus on contribution from the resonantly scattered cosmic X-ray background (CXB). If the significant part of the CXB emission is resolved into point sources, the properties of the WHIM along the line of sight are recorded in the absorption lines in the stacked spectrum of resolved sources and in the emission lines in the remaining diffuse signal. For the strongest resonant lines, this implies a factor of ~ 30 boost in emissivity compared to the intrinsic emissivity over the major part of the density-temperature parameter space region relevant for WHIM. The overall boost for the 0.5-1 keV band is ~ 4, declining steeply at temperatures above 10^6 K and over-densities $\delta > 100$. In addition to the emissivity boost, contribution of the resonant scattering changes relative intensities of the lines, so it should be taken into account when line-ratio-diagnostics from high resolution spectra or redshift determination from low resolution spectra are considered. Comparison between WHIM signatures in X-ray absorption and emission should allow differentiating truly diffuse gas of small overdensity from denser clumps having small filling factor by future X-ray missions.

Presenter status

Primary author(s) :   Dr KHABIBULLIN, Ildar (MPA/IKI);   Dr CHURAZOV, Eugene (MPA/IKI)

Contribution ID : **10**   Type : **Poster**

Strong anisotropy of the X-ray luminosity-temperature relation of galaxy clusters and the eROSITA potential

The isotropy of the late Universe and consequently of the X-ray galaxy cluster scaling relations is an assumption greatly used in astronomy. However, many studies have recently reported deviations from isotropy using various cosmological probes, with a definitive conclusion yet to be made. New, effective and independent methods to robustly test the cosmic isotropy are of crucial importance. We use such a method, namely the directional behavior of the X-ray luminosity-temperature ($L_X - T$) relation of galaxy clusters. While the measured luminosity depends on the underlying cosmology, the temperature can be determined without any cosmological assumptions. Exploiting this property and the homogeneous sky coverage of X-ray galaxy cluster samples, one can effectively test the isotropy of cosmological parameters over the full extragalactic sky. Using >300 X-ray galaxy clusters included in eeHIFLUGCS, we find that the behavior of the $L_X - T$ relation heavily depends ($> 4\sigma$) on the direction of the sky. Several effects that could potentially explain these strong anisotropies were examined, but none was able to explain the obtained results. Interestingly, other cluster samples appear to have a similar behavior throughout the sky. Combining 3 independent samples results in 842 different galaxy clusters with luminosity and temperature measurements. Performing a joint analysis, the final anisotropy is further intensified ($> 5\sigma$), found towards $(l, b) \sim (303°, -27°)$, in very good agreement with other cosmological probes. The maximum variation of H_0 seems to be $\sim 16 \pm 3\%$ for different regions in the sky ($\sim 35\%$ in terms of the $L_X - T$ normalization). This result robustly demonstrates that X-ray studies that assume perfect isotropy in the properties of galaxy clusters and their scaling relations can produce strongly biased results whether the underlying reason is cosmological or related to X-rays. The identification of the exact nature of these anisotropies is therefore crucial for any statistical cluster physics or cosmology study. Finally, we show how the eROSITA All-Sky Survey, which will provide us with numerous high quality cluster data, will help us to better understand the origin of these anisotropies.

Presenter status

Primary author(s) : MIGKAS, Konstantinos (AIfA, University of Bonn); SCHELLENBERGER, Gerrit (CfA, Harvard); REIPRICH, Thomas H. (AIfA, University of Bonn); PACAUD, Florian (AIfA, University of Bonn); RAMOS-CEJA, Miriam E. (MPE, Garching); LOVISARI, Lorenzo (CfA, Harvard)

Presenter(s) : MIGKAS, Konstantinos (AIfA, University of Bonn)

Contribution ID : **11**   Type : **Poster**

Constraining AGN physics, evolution and cosmology through X-ray variability

In the last few year it has become increasingly evident that the study of X-ray variability of high redshift AGNs enables us to constrain the physics and evolution of accreting supermassive Black Holes through cosmic time, and to use them as cosmological probes. eRosita will provide variability data for large AGN samples allowing us to significantly reduce the current uncertainties, provided that the biases due to sparse temporal sampling are properly accounted for. I will discuss the lesson learned from studies of high redshift AGNs in deep surveys such as the Chandra Deep Field South, COSMOS etc., and how it can be applied to the next generation of X-ray survey data in order to make them competitive with different physical probes.

Presenter status

Primary author(s) :   PAOLILLO, Maurizio (Università di Napoli Federico II)

Contribution ID : **12** Type : **Oral Presentation**

XMM-Newton Joint Observing Programs and TOOs: Potential for Synergies with eROSITA

Friday, 20 March 2020 12:30 (15)

XMM-Newton supports currently nine joint programs and observes about 30% of its high priority targets simultaneously with other facilities. In addition, the observing program shows and exceptional high amount of TOO observations in comparison to other large observatory class mission. The talk describes the policy for joint programs and TOO and reflects on the potential for synergies with eROSITA.

Presenter status

Primary author(s) : SCHARTEL, Norbert (ESA)

Presenter(s) : SCHARTEL, Norbert (ESA)

Session Classification : Time domain and multi-messenger astronomy

Contribution ID : **13**

Type : **Oral Presentation**

Unraveling the origin of non-thermal phenomena in merging galaxy clusters with eROSITA, LOFAR, and Planck

Tuesday, 17 March 2020 12:35 (15)

Mergers between galaxy clusters are the most energetic phenomena in the Universe. During these cosmic collisions, turbulence and shocks are generated into the ICM where they are believed to power Mpc-scale diffuse synchrotron sources in form of radio halos and radio relics. Nowadays, studies on non-thermal phenomena in merging galaxy clusters have been limited to a few tens of massive systems (M500 > 5-6 x 10^14 Msun), which host the most powerful halos and relics. Thanks to the all-sky surveys performed with eROSITA, LOFAR, and Planck, we will finally be in the position to extend these studies over a broad range of cluster mass and redshift and thus to unravel the origin of radio diffuse sources in the ICM.

The Planck Sunyeav Zel'dovic catalog collects a nearly mass-selected sample of galaxy clusters. We are carrying out the analysis of LOFAR observations coming from LoTSS (that is an on-going radio survey aimed at imaging the entire northern sky at 120-168 MHz) of all these systems to perform the largest statistical study ever done on non-thermal phenomena in galaxy clusters. However, many of the Planck clusters do not have X-ray information available at the moment. In this respect, the eROSITA survey will have a critical role, allowing us to understand the dynamical state of the clusters and thus to study the occurrence of diffuse radio emission in merging galaxy clusters.

In my talk, I will present the current status of the LOFAR analysis based on ~300 Planck clusters observed in the context of LoTSS. A large fraction of these systems host diffuse radio sources in the ICM, for the very first time detected in low-mass (M500 < 5 x 10^14 Msun) and high-z (z>0.6) systems. These clusters are fundamental to test the theoretical models of the formation of halos and relics. The eROSITA survey will detect these systems, which are below the sensitivity of the ROSAT All-Sky Survey, allowing us to study the interplay between thermal and non-thermal components in the ICM.

Presenter status

Primary author(s) : Dr BOTTEON, Andrea (Leiden Observatory)

Co-author(s) : LOFAR CLUSTERS WORKING GROUP

Presenter(s) : Dr BOTTEON, Andrea (Leiden Observatory)

Session Classification : Clusters and Cosmology I

Contribution ID : **14**   Type : **Poster**

Optically defined merging clusters and multi-wavelength follow-up observations

We present multi-wavelength studies (optical, weak-lensing, X-ray, SZE and radio synchrotron) of optically defined major-mergers from the CAMIRA cluster catalog of the HSC-SSP Survey and results of follow-up observations of high angular resolution GBT/MUSTANG-2 SZE measurements and XMM-XXL X-ray images of three CAMIRA clusters. Luminous red galaxies make a homogeneous sample of cluster mergers at various merging stages and unbiased with respect to the merger boost of the ICM. However, it is difficult to discriminate between pre- and post- mergers and thus multi-wavelength follow-up observations are crucial for understanding merger physics. The average halo concentration for the merging clusters is ∼70% smaller than that of the other clusters. We find a signature of the merger boost of the ICM from the stacked Planck Sunyaev-Zel'dovich effect and ROSAT X-ray luminosity, but not in optical richness. The stacked X-ray surface brightness distribution, aligned with the main subhalo pairs of low-redshift and massive clusters, shows that the central gas core is elongated along the merger axis, and overall gas distribution is misaligned by ~ 60 deg. The combination of high angular resolution SZE and X-ray imaging enables a spatially resolved multi-component analysis. The S_X and y distributions are perturbed at some level, regardless of the optical properties. In particular, the joint SZE and X-ray analysis reveal that temperatures of double y peaks in an optically-defined major merger reach $\sim 20-30$ keV in contrast to the cool core component of ~ 2 keV. We find that an integrated Compton y parameter and a temperature for a major merger are significantly boosted from those expected by the weak-lensing mass and those for the other two clusters show no significant deviations.

Presenter status

Primary author(s) :   OKABE, Nobuhiro (Hiroshima Univ.)

Presenter(s) :   OKABE, Nobuhiro (Hiroshima Univ.)

Contribution ID : **15**   Type : **Poster**

Re-estimate the Spin of the Black Hole in Cygnus X-1

Cygnus X-1 is a well-studied persistent black hole X-ray binary. Recently, three dynamical parameters of this system, namely the black hole mass M, the orbital inclination i and the source distance D, have been updated. This present work attempts to refine the spin of the black hole with these new parameters. The continuum- fitting technique is adopted in this work. Based on the assumption that the spin axis of the black hole is aligned with the orbital plane, we fit the thermal disk component to a fully relativistic thin accretion disk model. The error in spin from the combined observational uncertainties is obtained via Monte Carlo (MC) simulations. We demonstrate that the new spin parameter is constrained to be $a_* > 0.9985$ (3σ), which confirms that the spin of the black hole in Cygnus X-1 is extreme.

Presenter status

Primary author(s) :   ZHAO, Xueshan

Co-author(s) :   GOU, Lijun;   ZHENG, Xueying (National Astronomical Observatories, Chinese Academy of Sciences);   DONG, Yanting

Contribution ID : **16**   Type : **Poster**

X-ray to gamma-ray virial shock signal from the Coma cluster

Following evidence for an east–west elongated virial ring around the Coma galaxy cluster in a $\sim 220\,\mathrm{GeV}$ VERITAS mosaic, we search for corresponding signatures in $>\mathrm{GeV}$ γ-rays from Fermi-LAT, and in soft, $\sim 0.1\,\mathrm{keV}$ X-rays from ROSAT.

For the ring elongation and orientation inferred from VERITAS, we find a nominal 3.4σ LAT excess, and the expected signature ($> 5\sigma$) in ROSAT bands R1 and R1+R2.

The significances of both LAT and ROSAT signals are maximal near the VERITAS ring parameters. The intensities of the ROSAT, Fermi, and VERITAS signals are consistent with the virial shock depositing $\sim 0.3\%$ (with an uncertainty factor of ~ 3) of its energy over a Hubble time in a nearly flat, $p \equiv -d \ln N_e / d \ln E \simeq 2.0$–$2.2$ spectrum of cosmic-ray electrons.

The sharp radial profiles of the LAT and ROSAT signals suggest preferential accretion in the plane of the sky, as indicated by the distribution of neighboring large-scale structure.

The X-ray signal gauges the compression of cosmic-rays as they are advected deeper into the cluster. Using eRosita, which has better resolution and sensitivity than ROSAT can help us to better constrain the measurements in Coma and to detect more virial rings in the X-rays in other clusters.

Presenter status

Primary author(s) :   REISS, Ido (Ben Gurion University); KESHET, Uri (Ben-Gurion University of the Negev)

Contribution ID : **17**   Type : **Oral Presentation**

X-ray spectroscopy of the outskirts of the Perseus Cluster: a shock front near the virial radius

Tuesday, 17 March 2020 17:00 (15)

Previous X-ray studies of the Perseus Cluster, consisting of 85 Suzaku pointings along eight azimuthal directions, revealed a particularly steep decrease in the deprojected temperature profile near the virial radius r_{200} along the northwest (NW). We have investigated four additional Suzaku observations mapping this region, with a total exposure of ~100 ks. With this deeper data set, designed to have the best possible control of systematic uncertainties, we find that the temperature gradient is indeed much larger than the other seven directions and significantly deviates from the predictions from hydrodynamic simulations. It is noteworthy that the slope of the deprojected temperature profile is not continuous, with a break near r_{200}.We also find a corresponding density jump at a radius of 1.8 Mpc, similar to the location of the temperature break, indicating the presence of a shock front. This potential evidence of a shock front so far away from the cluster center is unprecedented, and may provide a first insight into the properties of large-scale virial shocks which shape the process of galaxy cluster growth. This study serves as a pathfinder for more such features that may be revealed in nearby galaxy clusters, taking advantage of eROSITA's large field of view, stable background, and improved spatial resolution compared to Suzaku.

Presenter status

Primary author(s) :   Ms ZHU, Zhenlin (SRON/Leiden University)

Co-author(s) :   Dr SIMIONESCU, Aurora (SRON/Leiden University); Dr AKAMATSU, Hiroki (SRON); Prof. KAASTRA, Jelle (SRON/Leiden University)

Presenter(s) :   Ms ZHU, Zhenlin (SRON/Leiden University)

Session Classification :   Clusters and Cosmology II

Contribution ID : **19**   Type : **Oral Presentation**

Probing the winds of the most massive stars using high mass X-ray binaries

Thursday, 19 March 2020 15:00 (15)

In high mass X-ray binaries (HMXBs), the black hole or neutron star accretes matter from the wind of a massive supergiant companion: the stellar wind drives changes in the accretion and thus the system's X-ray emission. But the interaction of this emission with the wind material can also be used to study the wind itself, in particular its geometry, porosity (or clumpiness), mass-loss rate and interaction with the compact object. Such winds are strong and fast and can significantly influence the evolution of massive stars; their observational studies are, however, hampered by a lack of direct diagnostics of the stellar structure. HMXBs are our unique chance to probe these wind structure, in particular through the variable absorption imprinted by the wind onto the continuum emission.

In this talk, I will address some of our recent work on understanding wind accretion in the HMXBs, focusing on different variability timescales. High resolution spectroscopy reveals a complex, multi-phase medium such as would be expected in the case of cold clumps embedded in a hotter wind. X-ray color-color diagrams can be used to assess absorption dips on timescales as short as a few tens seconds even in faint HMXBs; the resulting measure of the stochastic absorption variability constrains the size of the wind clumps. Low cadence observations allow us to constrain the orbital variability of absorption and through it the large-scale accretion geometry onto the compact object and the porosity of wind of the massive stellar companion. I will in particularly highlight how population studies that will be enabled by eROSITA will help us to understand the evolution of the wind properties in HMXBs.

Presenter status

Primary author(s) : GRINBERG, Victoria (Institut für Astronomie und Astrophysik, Eberhard Karls Universität Tübingen)

Co-author(s) : EL MELLAH, Ileyk; LEUTENEGGER, Maurice; NOWAK, Michael A.; HELL, Natalie

Presenter(s) : GRINBERG, Victoria (Institut für Astronomie und Astrophysik, Eberhard Karls Universität Tübingen)

Session Classification : X-ray view of the Milky Way: Compact Objects

Contribution ID : **20**
Type : **Poster**

Intra-cluster X-ray Source Populations in Virgo and Fornax

X-ray-emitting, close binary systems are among the first objects discovered in the X-ray sky and now understood to be ubiquitous in the Universe. As such, X-ray binaries can serve as a useful tool to study the evolution of their parent stellar populations, on scales from star clusters to galaxy clusters. We report observational evidence for the presence of intra-cluster X-ray sources that are not associated with the main stellar content of the individual galaxies nor with the cosmic X-ray background in the two nearest galaxy clusters, Virgo and Fornax, based primarily on archival Chandra observations. We discuss the origin of these sources, in terms of supernova-kicked low-mass X-ray binaries (LMXBs), LMXBs in globular clusters, LMXBs associated with the diffuse intra-cluster light, tidally-stripped nucleated dwarf galaxies and free-floating massive black holes. The discovery of intra-cluster X-ray sources opens a new avenue for studying the structural growth in galaxy clusters. With the large sky area of Virgo and Fornax, the all-sky survey by the eROSITA mission is expected to find at least 10 times more intracluster X-ray sources, which will form a statistically meaningful sample for exploring the physical properties and formation history of the ICL in the two clusters.

Presenter status

Primary author(s) : HOU, Meicun (Nanjing University)

Co-author(s) : LI, Zhiyuan (Nanjing University); PENG, Eric (Peking University); LIU, Chengze (Shanghai Jiao Tong University)

Presenter(s) : HOU, Meicun (Nanjing University)

Contribution ID : **21**   Type : **Oral Presentation**

The Atacama Large Aperture Submm Telescope (AtLAST): A widefield, ground-based complement to eROSITA

Tuesday, 17 March 2020 16:45 (15)

The thermal and kinematic SZ effects provide a strong and independent complement to X-ray observations of the warm and hot ionised intracluster and intergalactic media, particularly at high redshift where X-ray counts are limited. Being observable from the ground, new instrumentation for the SZ effects can be developed more rapidly and can be upgraded more readily. I will discuss a newly proposed research infrastructure, which has a high profile in the US Astro2020 decadal and Canadian Long Range Plan 2020 submissions as well broad international support, for a 50-meter-class widefield submm/mm telescope capable of observing the multifaceted SZ effect and disentangling it from contaminating radio and dusty submm sources. This will provide $10''$ resolution at 150 GHz (near the peak of the thermal SZ decrement) and a 2 degree instantaneous field of view.

Presenter status

Primary author(s) :   MROCZKOWSKI, Tony (ESO)

Presenter(s) :   MROCZKOWSKI, Tony (ESO)

Session Classification :   Clusters and Cosmology II

Contribution ID : **22**   Type : **Poster**

Evidence of an accretion disk in wind-fed X-ray pulsar Vela X-1 during an unusual spin-up period

In classical supergiant X-ray binaries (SgXBs), the Bondi-Hoyle-Lyttleton wind accretion was usually assumed which caused negligible changes in angular momentum of accretors. The observed spin-up of the neutron star, however, is still a hanging problem. In this paper, we report an extended low state of Vela X-1 (at about orbital phases 0.16−0.2), lasting for at least 30 ks, observed with *Chandra* during the onset of an unusual spin-up period. During this low state, the continuum fluxes dropped by a factor of 10 compared to the preceding flare period, and the pulsation of the continua almost disappeared. Meanwhile, the Fe Kα fluxes of the low state were similar to the preceding flare, leading to an equivalent width (EW) of 0.6 keV, as high as the EW during the eclipse phase of Vela X-1. The pulsation cessation and the high Fe Kα EW indicate an axisymmetric structure with a column density larger than 10^{24} cm^{-2} on the spatial scale of the accretion radius of Vela X-1. These phenomena are consistent with the existence of an accretion disk that leads to the following spin-up of Vela X-1. It indicates that the disk accretion, although not always, does occur in classical wind-fed SgXBs.

Presenter status

Primary author(s) :   Mr LIAO, Zhen-Xuan (National Astronomical Observatory of China)

Co-author(s) :   Prof. LIU, Jiren (National Astronomical Observatory of China); Ms ZHENG, Xueying (National Astronomical Observatory of China); Prof. GOU, Lijun (National Astronomical Observatory of China)

Contribution ID : **23**   Type : **Poster**

The spin measurement of the black hole in 4U 1543-47 constrained with the X-ray reflected emission

4U 1543-47 is a low mass X-ray binary which harbours a stellar-mass black hole located in our Milky Way galaxy. In this paper, we revisit 7 data sets which were in the Steep Power Law state of the 2002 outburst. The spectra were observed by the Rossi X-ray Timing Explorer. We have carefully modelled the X-ray reflection spectra, and made a joint-fit to these spectra with relxill, for the reflected emission. We found a moderate black hole spin, which is $0.67^{+0.15}_{-0.08}$ at 90\% statistical confidence. Negative and low spins (< 0.5) at more than 99\% statistical confidence are ruled out. In addition, our results indicate that the model requires a super-solar iron abundance: $5.05^{+1.21}_{-0.26}$, and the inclination angle of the inner disc is $36.3^{+5.3}_{-3.4}$ degrees. This inclination angle is appreciably larger than the binary orbital inclination angle ($\sim$21 degrees); this difference is possibly a systematic artefact of the artificially low-density employed in the reflection model for this X-ray binary system.

Presenter status

Primary author(s) :   DONG, Yanting

Co-author(s) :   STEINER, James F.; GARCIA, Javier A.; GOU, Lijun

Contribution ID : **24**   Type : **Poster**

A Detailed Study on the Reflection Component for the Black Hole Candidate MAXI J1836-194

We present a detailed spectral analysis of the black hole candidate MAXI J1836- 194. The source was caught in the intermediate state during its 2011 outburst by Suzaku and RXTE. We jointly fit the X-ray data from these two missions using the relxill model to study the reflection component, and a steep inner emissivity profile indicating a compact corona as the primary source is required in order to achieve a good fit. In addition, a reflection model with a lamp-post configuration (relxilllp), which is normally invoked to explain the steep emissivity profile, gives a worse fit and is excluded at 99% confidence level comparing to relxill. We also explored the effect of the ionization gradient on the emissivity profile by fitting the data with two relativistic reflection components, and it is found that the inner emissivity flattens. These results may indicate that the ionization state of the disc is not constant. All the models above require a supersolar iron abundance higher than ~4.5. However, we found that the high-density version of reflionx can describe the same spectra even with solar iron abundance well. A moderate rotating black hole ($a^* = 0.83\text{-}0.94$) is consistently obtained by our models, which is in agreement with previously reported values.

Presenter status

Primary author(s) :   DONG, Yanting

Co-author(s) :   GOU, Lijun; ZHAO, Xueshan; ZHENG, Xueying (National Astronomical Observatories, Chinese Academy of Sciences); JARCIA, Javier A.; LIU, Zhu

Contribution ID : 25 Type : **Oral Presentation**

AGN identification with machine-learning methods

Monday, 16 March 2020 17:55 (15)

Several pieces of evidence have been pilling up in the literature leading towards an evolutionary scenario for AGN, moving past the standard unified model. Part of this amounting evidence is the little overlap of AGN samples selected with various identification criteria. Given the rarity of the AGN population, large and complete samples are needed to assess such an evolutionary model and clarify the growth of black holes and a potential coevolution with their host galaxies.

X-rays are undoubtedly an optimal AGN identification method as revealed by XMM-Netwon, Chandra, and now eROSITA. However, deep all sky surveys such as LSST and Euclid will provide at least one order of magnitude larger galaxy samples compared to the most optimistic predictions of eROSITA. I will present three recent approaches using multiwavelength datasets tailored to identify AGN with machine-learning methods. These methods have been developed and tested on available optical, near infrared and X-ray public datasets and will reach their true potential with the combined power of LSST, Euclid and eROSITA.

Presenter status

Primary author(s) : FOTOPOULOU, Sotiria (University of Bristol)

Presenter(s) : FOTOPOULOU, Sotiria (University of Bristol)

Session Classification : AGN Surveys and the history of accretion

Contribution ID : **26**   Type : **Oral Presentation**

Surveys of Normal Galaxies at harder X-ray energies with NuSTAR

Wednesday, 18 March 2020 11:45 (15)

Since its launch in 2012, NuSTAR, as the first imaging X-ray observatory to operate in the 3-80 keV band, has executed an observing program on normal and starburst galaxies, including several galaxies in the Local Group, through a combination of science team, Legacy project, and Guest Observer time. We report on recent results from a synthesis analysis of a dozen galaxies observed by NuSTAR, including an analysis that divides X-ray binaries by compact object type (neutron star vs black hole), and measurement of the overall hard X-ray SED of galaxies. We have found a nearly universal turnover in the hard X-ray SED that may be attributed to super-Eddington accretion onto ULX sources. We have also found that the NS Luminosity function may have a turnover near the Eddington limit for a 1.4 solar mass NS. We discuss our findings on NS/BH ratios in galaxies and prospects for the future. In closing, we touch upon follow up in the harder X-ray band by NuSTAR and successor facilities of interesting subclasses of eROSITA-observed galaxies.

Presenter status

Primary author(s) :   HORNSCHEMEIER, Ann (NASA GSFC)

Co-author(s) :   Dr VULIC, Neven (University of Maryland College Park/NASA GSFC); Dr YUKITA, Mihoko (NASA GSFC/JHU); Ms LAZZARINI, Margaret (University of Washington, Seattle); Dr ZEZAS, Andreas (University of Crete); Dr ANTONIOU, Valsamo (Smithsonian Astrophysical Observatory); Dr GAROFALI, Kristen (University of Arkansas); Dr LEHMER, Bret (University of Arkansas); Dr MAC-CARONE, Thomas (Texas Tech University); Dr PTAK, Andrew (NASA GSFC); Dr VENTERS, Tonia (NASA GSFC); Dr WIK, Daniel (University of Utah); Dr WILLIAMS, Ben (University of Washington, Seattle)

Presenter(s) :   HORNSCHEMEIER, Ann (NASA GSFC)

Session Classification : X-ray emission from Galaxies

Contribution ID : **27**   Type : **Oral Presentation**

X-ray Surveys and the Evolution of Normal Galaxy Emission: Prospects for eROSITA

Wednesday, 18 March 2020 11:15 (30)

Surveys of the extragalactic Universe, from ultraviolet to infrared wavelengths, have been extremely effective at piecing together a basic picture of how stars in galaxies evolved throughout cosmic history. At X-ray wavelengths, normal-galaxy emission (i.e., not due to AGN) is dominated by hot gas and populations of X-ray binaries (XRBs). eROSITA is expected to detect ~10,000 normal galaxies in X-rays, much larger than the populations of 100s of normal galaxies that are currently studied in X-ray surveys. In this talk, I will review recent efforts to establish an empirical framework that characterizes how the X-ray emission from normal-galaxy populations varies with galaxy properties like star-formation history and metallicity. I will present estimates of how the X-ray emission from galaxies likely evolved over cosmic time in response to changes in galaxy star-formation activity and metallicity. I will show that X-ray emissivity of the Universe at z > 4-6 is expected to be dominated by normal-galaxy populations and could provide significant heating of the early intergalactic medium (IGM) before the epoch of reionization in the Universe. Finally, I will discuss how eROSITA will help to fill important knowledge gaps in our empirical framework, and provide broader new insight into galaxy evolution and the X-ray radiation field of the early IGM.

Presenter status

Primary author(s) :   LEHMER, Bret (University of Arkansas)

Presenter(s) :   LEHMER, Bret (University of Arkansas)

Session Classification :   X-ray emission from Galaxies

Contribution ID : **28**   Type : **Poster**

Thermal emission from bow shocks: Multi-dimensional Hydrodynamic and Magneto-Hydrodynamic Models of the Bubble Nebula

The Bubble Nebula (or NGC 7635) is a parsec-scale seemingly spherical windblown bubble around the relatively unevolved O star BD+60∘2522. The young dynamical age of the nebula and significant space velocity of the star suggest that the Bubble Nebula might be a bow shock. We ran 2D hydrodynamic simulations to model the interaction of the wind of the central star with the interstellar medium (ISM). The models cover a range of possible ISM number densities of n = 50–200 cm^{-3} and stellar velocities of v⊠ = 20–40 km s^{-1}. The best-matching simulation had v⊠ ≈ 20 km s^{-1} into an ISM with n ~ 100 cm^{-3}, at an angle of 60∘ with respect to the line of sight. Synthetic Hα and 24 μm emission maps were produced to compare with observations and synthetic maps of soft (0.3–2 keV) and hard (2–10 keV) X-ray emission were produced. The predicted unabsorbed soft X-rays have a luminosity of ~ 10^{32} – 10^{33} erg s^{-1}. The hard X-rays are predicted to be much fainter: ~ 10^{30} – 10^{31} erg s^{-1}, and may be too faint for current X-ray instruments to successfully observe. We are following up this 2D study with 3D magneto-hydrodynamic simulations of the Bubble Nebula. Synthetic Hα, 24 μm, and X-ray emission maps have again been produced to compare with observational data. Our results imply that the O star creates a bow shock as it moves through the ISM and in turn creates an asymmetric bubble visible at optical and infrared wavelengths and predicted to be visible in X-rays. This is the first description of the Bubble Nebula that quantitatively agrees with available observational data and makes a clear prediction for X-ray observations. Our results can test the feedback efficiency from stellar winds to the interstellar medium.

Presenter status

Primary author(s) :   GREEN, Samuel (DIAS)

Co-author(s) :   MACKEY, Jonathan (DIAS); HAWORTH, Thomas J.; GVARAMADZE, Vasilii V.; DUFFY, Peter

Contribution ID : **29**   Type : **Poster**

An early-type galaxy in our backyard: A broadband X-ray study of LMXBs in Maffei 1

Elliptical galaxies, especially those lacking an actively accreting supermassive black hole dominating the X-ray emission, tend to be located outside our immediate local neighbourhood, and should present an area of significant gain by the eROSITA survey. We highlight some of the science that is feasible with detailed studies of early-type galaxies via presentation of preliminary results from recent contemporaneous Chandra and NuSTAR observations of the nearest giant elliptical galaxy Maffei 1 (3.4 Mpc), the dominant member of the Maffei group of galaxies. We study the dynamical evolution of low-mass X-ray binaries (LMXBs) by probing evidence for an excess population at large galactocentric radii. Such studies provide interesting constraints on supernova kicks. We investigate the origin of the excess of LMXBs at large galactocentric radii by using multiwavelength data to separate LMXBs into globular cluster and field sources. Using NuSTAR's E>10 keV sensitivity we classify LMXB compact object types (separating neutron stars from black holes). We discuss the results in the context of supernova-kicked sources and the characteristics of the distribution of black holes and neutron stars among the LMXB population.

Presenter status

Primary author(s) :   Dr VULIC, Neven (University of Maryland College Park/NASA GSFC)

Co-author(s) :   HORNSCHEMEIER, Ann (NASA GSFC); Dr ANTONIOU, Valsamo (Smithsonian Astrophysical Observatory); Prof. BARMBY, Pauline (University of Western Ontario); COLEY, Joel (NASA Goddard Space Flight Center); Dr FORNASINI, Francesca (Harvard Smithsonian Center for Astrophysics); Prof. GALLAGHER, Sarah (University of Western Ontario); Dr LEHMER, Bret (University of Arkansas); Dr MACCARONE, Thomas (Texas Tech University); Dr PTAK, Andrew (NASA GSFC); Dr WIK, Daniel (University of Utah); Dr WILLIAMS, Ben (University of Washington, Seattle); Dr YUKITA, Mihoko (NASA GSFC/JHU); Dr ZEZAS, Andreas (University of Crete)

Presenter(s) :   Dr VULIC, Neven (University of Maryland College Park/NASA GSFC)

Contribution ID : **30**   Type : **Oral Presentation**

The chemical history of galaxy clusters, groups, and ellipticals - Advances from previous missions and insights with eROSITA

Tuesday, 17 March 2020 12:20 (15)

Although they are the building blocks of rocky planets and even life, the major fraction of metals in the Universe is found outside galaxies, within a hot, ionized intergalactic phase. When this plasma is hot and dense enough to glow in X-rays (i.e. pervading galaxy clusters, groups, and surrounding isolated elliptical galaxies), the abundance of key chemical elements can be measured via spectroscopy; hence providing us with crucial clues on the chemical history and evolution of large scale structures. In particular, past X-ray missions revealed that the bulk of metals in the in-tracluster medium was already in place *before* cluster formation, i.e. more than ~10 Gyr ago. In hot atmospheres pervading galaxy groups and ellipticals, however, the picture is less clear and many open questions remain. Whereas microcalorimeters onboard future missions (e.g. *XRISM*, *Athena*) will certainly bring a plethora of decisive results, moderate resolution spectroscopy combined with an unprecedented grasp has the potential to considerably improve our current knowledge of how and when these systems got chemically enriched. Here, we will review some of the most important results achieved with *XMM-Newton*, *Chandra*, and *Suzaku*, and we will show how (and on which aspects) eROSITA can push our understanding of galaxies and clusters enrichment to the next level.

Presenter status

Primary author(s) :   MERNIER, Francois (European Space Agency / ESTEC)

Presenter(s) :   MERNIER, Francois (European Space Agency / ESTEC)

Session Classification :   Clusters and Cosmology I

Contribution ID : **31**   Type : **Oral Presentation**

Unravelling Galaxy Cluster Evolution with Combined SZ & X-ray Surveys

Tuesday, 17 March 2020 11:50 (15)

The recent combination of deep Sunyaev Zel'dovich (SZ) surveys with pointed X-ray follow-up has enabled the study of the intracluster medium across most of cosmic time. In particular, within the South Pole Telescope (SPT) collaboration, we have been utilizing Chandra and XMM-Newton follow-up of SPT-selected clusters to study the evolution of the dynamical state, the cooling/heating balance, and the metal enrichment of the intracluster medium over the past 10 Gyr. I will briefly summarize these results, before describing the numerous synergies of SPT-3G and eRosita, and previewing how these combined observatories will further unravel the complex history of the intracluster medium.

Presenter status

Primary author(s) :   MCDONALD, Michael (MIT)

Presenter(s) :   MCDONALD, Michael (MIT)

Session Classification :   Clusters and Cosmology I

Contribution ID : **32**   Type : **Poster**

Statistical Constraints on Gas Clumping in Galaxy Cluster Outskirts with X-ray Angular Power Spectra

Gas clumping in the outskirts of galaxy clusters is one of the major unexplored astrophysics in cluster formation. We present the first statistical constraint on gas clumping with the combined X-ray angular power spectra measured from the ROSAT All-Sky Survey and the Chandra/XBootes field. The gas clumping factor of group and clusters at $< R200m$ is constrained to be $C = 1.7 +1.8/-0.5$ at the the 1 sigma level, consistent with previous measurements of clumping in individual clusters. We discuss how to improve constraints on gas clumping and other ICM physics (such as non-thermal pressure and feedback from active galactic nuclei) with ongoing and upcoming X-ray (such as eRASS), microwave, and gravitational lensing observations.

Presenter status

Primary author(s) : Prof. CAPPELLUTI, Nico (University of Miami); KOLODZIG, Alexander (Institut d'Astrophysique Spatiale (CNRS/ Université Paris Sud)); Dr LAU, Erwin (University of Miami); Prof. NAGAI, Daisuke (Yale University); Dr SHIRASAKI, Masato (NAOJ)

Presenter(s) : Dr LAU, Erwin (University of Miami)

Contribution ID : **33**   Type : **Poster**

Searching for supermassive black hole binaries in the X-ray time domain

Theory predicts that an accreting supermassive black hole binary (SMBHB) could be observed as an active galactic nucleus (AGN) that periodically varies in luminosity on the order of its orbital timescale, due to mechanisms such as binary-modulated accretion and relativistic Doppler boost. Several studies have searched for periodically varying quasars as possible SMBHBs in optical time domain surveys, but this signature remains largely unexplored in the X-ray regime. I will discuss our recent search for periodic AGN in the Swift Burst Alert Telescope data set, which is the first systematic study of the hard X-ray variability signature of SMBHBs. I will also discuss the detectability of SMBHBs and the more fruitful search strategy in the context of the eROSITA survey. The discovery of such systems would be of high significance in this new era of multi-messenger astronomy, as they are the possible EM counterparts of nanohertz gravitational-wave sources for the pulsar timing array experiments.

Presenter status

Primary author(s) :   Dr LIU, Tingting (University of Wisconsin - Milwaukee)

Presenter(s) :   Dr LIU, Tingting (University of Wisconsin - Milwaukee)

Contribution ID : **34**   Type : **Oral Presentation**

Transient ULXs and prospects for SRG

Friday, 20 March 2020 12:15 (15)

Ultraluminous X-ray sources are powerful extra-nuclear sources of X-rays found in nearby galaxies, which in most cases are believed to be powered by super-Eddington accretion onto neutron stars and black holes. While most known ULXs are persistent sources, recently some new sources have been found that appear to come and go. I will present results from a systematic search for these transient ULXs in Swift/XRT data, what they might tell us about super-Eddington accretion, and discuss the prospects for SRG surveys.

Presenter status

Primary author(s) :   Dr MURRAY, Brightman (Caltech)

Presenter(s) :   Dr MURRAY, Brightman (Caltech)

Session Classification :   Time domain and multi-messenger astronomy

Contribution ID : **35**   Type : **Poster**

A Tidal Disruption Event Candidate Discovered in the Active Galactic Nucleus SDSS J0227-0420

We report the discovery of a Tidal Disruption Event (TDE) candidate occurring in the Active Galactic Nucleus SDSS J02277-0420. A sudden increase in flux of J0227-0420 during the second half of 2009 is clearly shown in the long-term optical, UV, and NIR light curves. A plateau phase, following an initial decline, is seen in the NUV and optical u, g, r, i light curves. The plateau phase in the NUV band lags behind the optical ones by approximately 70–80 days with also a much shorter duration, i.e. ~7–15 days against ~40–50 days. The long-term NUV/optical (after the plateau phase), NIR and MIR light curves can be well characterized with a form of $L(t) \propto t^{-\beta}$, consistent with the expectation of a TDE. The lag between the NUV and optical plateau phase may attribute to the viscosity decay, i.e. the fallback material moving towards the BH after the stellar streams colliding with the pre-existing accretion disk, implying that the optical/NUV flares are originated from the accretion process. The index β of the NIR band (~ 2.1 – 2.7) is steeper than that of the UV/optical (~ 0.7 – 1.0) and MIR bands (~ 1.2 – 1.4), suggesting that a certain fraction of the dust in the inner region of the dusty torus may be sublimated during the TDE phase. Our results indicate that, due to collisions between stellar debris and pre-existing disk, the light curves of TDEs occurring in AGN may show distinctive features, which may shed new light on the accretion process.

Presenter status

Primary author(s) :   LIU, Zhu;   Ms LI, Dongyue;   Mr LIU, Heyang (NAOC);   Dr LU, Youjun (NAOC);   Dr YUAN, Weimin;   Dr DOU, Liming;   Prof. SHEN, Rongfeng

Contribution ID : **36**   Type : **Poster**

SRG prospects for Compton-thick AGN search in the AKARI NEP Wide Field

The North Ecliptic Pole region is a subject of deepest surveys with many space bourne observatories, including the infrared observatory AKARI and Spectrum-RG. In particular, as a legacy program of AKARI, it pursued dedicated AKARI NEP Deep (ANEPD;~0.5 deg^2) and Wide (ANEPW;~5.4 deg^2) surveys in the NEP area with its unique nine infrared bands continuously covering the wavelength range from 2 to 24 microns. The data available from the NEP survey from AKARI, Herchel, and optical deep images including those from new Subaru/Hyper Suprime Cam (HSC), added by future observations with Euclid and LMT-GTM/TolTEC camera enable us to make detailed Spectral Energy Distribution (SED) analyses. In particular, comparisons of the AGN torus hot dust component derived from the infrared SED analysis and the X-ray luminosity derived from eROSITA/ART-XC will allow us to identify highly absorbed AGNs including Compton-thick (CT) ones. In our preliminary estimation, we expect to find a few hundred (semi-) CT AGNs within the 5.4 deg2 ANEP-Wide region upon the completion of the Spectr-RG four year all-sky survey program. We show examples of CT AGNs from our current data from our AKARI NEP Deep Survey and discuss further prospects from the combination of ANEPW and Spectr.-RG.

Presenter status

Primary author(s) :   MIYAJI, Takamitsu (Universidad Nacional Autónoma de México)

Presenter(s) :   MIYAJI, Takamitsu (Universidad Nacional Autónoma de México)

Contribution ID : **37**   Type : **Poster**

Predictions for eROSITA Cluster Cosmology and Astrophysics from Simulations

For a number of the galaxy clusters in the eROSITA survey, there will be sufficient data to obtain a spectrum and determine a spectral temperature. These temperatures, along with the cluster luminosities, can be used to construct scaling relations. We produce mock eROSITA observations from clusters obtained from cosmological simulations and compare the fitted spectral temperature to the temperature obtained from the simulation, as well as quantify the effects of hydrostatic mass bias, merging, and gas clumping. I will discuss preliminary results of this investigation. I will also briefly discuss potential astrophysical applications of discovering new merging clusters in the eROSITA survey.

Presenter status

Primary author(s) :   ZUHONE, John (Smithsonian Astrophysical Observatory); Dr BIFFI, Veronica (LMU); Dr BULBUL, Esra (MPE); Dr DOLAG, Klaus (LMU)

Contribution ID : **38**   Type : **Poster**

All quasars {\bf do} have the same Black Hole mass!

Shanks et al (2011, MN, 416, 650) have previously argued that the luminosity and redshift independence of quasar clustering strength implies that all quasars have the same black hole mass. However, this result has been challenged by eg Aird et al (2012, ApJ, 746, 90) who, starting from an inventory of X-ray AGN in complete samples of faint galaxies, suggest that this result simply represents an observational selection effect and that AGN are associated with a wide range of black hole masses. Here we show that the results of Aird et al (2012) are completely compatible with the quasar clustering results and with the view that there is only a small range of black hole mass associated with AGN. Rather than being an observational selection effect, it now seems well established tha all quasars {\bf do} have the same black hole mass and we speculate on the physical origin of this result.

Presenter status

Primary author(s) : Prof. SHANKS, Tom

Contribution ID : **39** Type : **Poster**

The 4MOST Cosmology Quasar Redshift Survey

The 4MOST Cosmology Quasar Redshift Survey will combine with the eROSITA AGN X-ray survey to make a powerful survey for cosmology containing more than 1 million quasars. The aim is to extend the eROSITA AGN 4MOST survey from $\approx 50\text{deg}^{-2}$ to 130deg^{-2} over a 7500 deg^2 area covering the DES, KiDS and VST ATLAS surveys out to $z \approx 2.2$. The main goals are to exploit uniquely deep DES and LSST imaging to compare quasar-galaxy and quasar-CMB lensing with galaxy weak shear lensing and redshift space distortion results, usually in the same volume. These data will then be used to probe modified gravity models via their gravitational growth rate. The high quasar sky density means we shall also be able to compete with DESI to obtain $\approx 1\%$ BAO measurements out to $z \approx 2.2$ and to extend these measurements to higher redshift than EUCLID using the quasar Lyman-alpha forest. We shall also exploit completely new routes to quasar Hubble diagrams eg by using stacked reverberation mapping techniques, now combining 4MOST and LSST survey data.

Presenter status

Primary author(s) : Ms ELTVEDT, Alice (Durham University); Prof. SHANKS, Tom (Durham University); Dr RICHARD, Johan (CRAL, Lyon); Prof. KNEIB, Jean-Paul (EPFL, Switzerland)

Presenter(s) : Ms ELTVEDT, Alice (Durham University)

Contribution ID : **40**   Type : **Oral Presentation**

The local AGN survey (LASr): Towards a complete census of black hole growth within 100Mpc

Wednesday, 18 March 2020 10:30 (15)

In order to answer some of the major open questions in the fields of supermassive black hole (SMBH) and galaxy evolution, a complete census of SMBH growth, i.e., active galactic nuclei (AGN), is required. Thanks to the combination of the new deep all-sky surveys, such as those by the Wide-field Infrared Survey Explorer (WISE) and the Spectrum-Roentgen-Gamma (SRG) missions eROSITA and ART-XC, this task is now becoming feasible in the nearby Universe. We present a new survey, the Local AGN Survey (LASr), with the goal of identifying AGN unbiased against obscuration and determining the intrinsic Compton-thick (CT) fraction. As part of LASr, we have assembled the most complete all-sky sample of galaxies within 100Mpc from astronomical databases, four times deeper than the current local galaxy reference, the Two Micron All-Sky Survey Redshift Survey (2MRS), which turns out to miss ~20% of known luminous AGN. This galaxy sample will serve as parent sample to select AGN. We assemble and characterise all 4.3k known AGN within the volume and employ infrared colour selection to find new AGN candidates independent of their obscuration. The fact that none of these candidates have been detected by Swift/BAT yet indicates that the CT fraction is in the range of 40-55%. We estimate the efficiency of the infrared colour selection and use it to predict the total number of AGN in the volume, finding that a third of the objects are still undetected. Thanks to the deep flux limits, the all-sky surveys of eROSITA and ART-XC are going to detect many of these sources, while putting tight constraints on those that remain undetected and thus be CT. These X-ray information will be highly complementary to the infrared and help to overcome selection biases of the latter. Thus, the combination of infrared and X-ray selection of AGN is the best approach to obtain an unbiased and complete census of (significant) black hole growth in the local universe. Such a census will serve as redshift zero benchmark for AGN population studies, providing constraints on the AGN duty cycle, luminosity and accretion rate distributions and radiative efficiencies.

Presenter status

Primary author(s) :   Ms GREENWELL, Claire L. (University of Southampton);   ASMUS, Daniel (University of Southampton);   Dr BOORMAN, Peter;   GANDHI, Poshak

Presenter(s) :   ASMUS, Daniel (University of Southampton)

Session Classification :   AGN and their host galaxies

Contribution ID : **41**   Type : **Oral Presentation**

Ultra-compact Double Degenerate Binaries

Thursday, 19 March 2020 15:35 (15)

Double degenerate white dwarf binaries result from episodes of common envelope evolution and evolve to short orbital period through gravitational wave emission. When the lighter of the two white dwarfs fills its Roche Lobe, mass transfer is initiated onto the heavier white dwarf, resulting in X-ray emission. At sufficiently close separation, the transferred mass does not form an accretion disk, but rather the ballistic stream impacts the surface of the white dwarf, forming a "direct impact accretor". We will describe an eclipsing double degenerate binary with an orbital period of 6.9 minutes recently discovered by the Zwicky Transient Facility, and discuss the possibility that it exhibits low-level direct impact mass transfer, as well as our attempts to detect X-ray emission from the system. We will also discuss possibilities for detection of direct impact accretors with SRG.

Presenter status

Primary author(s) :   PRINCE, Thomas (Calech)

Co-author(s) :   BURDGE, Kevin (Caltech); FULLER, James (Caltech); KULKARNI, Shrinivas (Caltech); FOR THE ZTF PARTNERSHIP

Presenter(s) :   PRINCE, Thomas (Calech)

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **42**   Type : **Oral Presentation**

Signatures of Planetary Accretion onto Single White Dwarfs

It is now firmly established that remnant planetary systems orbit and pollute the surfaces of white dwarf stars with heavy elements, providing a unique empirical tool to assess the bulk composition of extrasolar planetary bodies. Yet despite the existence of myriad stars polluted by up to 15 heavy elements, and (self-consistent) model inferences for their mass accretion rates, there remains no detection of accretion luminosity. Only three accreting systems have been observed with pointed X-ray observations, which are expensive as a means to establish robust statistics and enable detections. We propose that eROSITA will serendipitously detect these systems during high-rate accretion states indicated by empirical data and theoretical models. By looking across a large fraction of the sky, eROSITA can provide the first empirical constraints on mass accretion rates onto polluted white dwarfs, provide invaluable information on nature of the (as yet unseen) parent bodies, and directly test theoretical models.

Presenter status

Primary author(s) :   Dr FARIHI, Jay (University College London)

Presenter(s) :   Dr FARIHI, Jay (University College London)

Session Classification :   X-ray view of the Milky Way: Stars

Contribution ID : **43** Type : **Poster**

Relativistic stars with conformal symmetry

We study exact models for anisotropic gravitating stars with conformal symmetry. The gravitational potentials are related explicitly by the conformal vector. We use this relationship between the metric potentials to find new classes of exact solutions to the field equations. We identify a particular model to study the physical features and demonstrate that the model is well behaved. In particular the criteria for stability are satisfied. We regain masses, radii and surface redshifts for the compact objects PSR J1614-2230 and SAX J1808.4-3658.

Presenter status

Primary author(s) : Prof. KILEBA, Didier (University of Kinshasa)

Contribution ID : 44   Type : **Oral Presentation**

Infant Supernova Explosions: the ZTF/SRG Synergy

Friday, 20 March 2020 09:30 (15)

The study of massive stars exploding as supernovae has seen a major breakthrough in recent years, with modern surveys making the detection and exploration of supernova explosions within a day of stellar core collapse possible. With its extremely wide field of view and mature infrastructure of integrated hardware, software and operations, the Zwicky Transient Facility (ZTF) has made such detections a matter of routine. The first hours and days of cosmic explosions reveal a plethora of new physics: from the physics of the energetic shock breakout flares, via measurement of the explosion energy and extending to extensive mapping of the exploding star parameters: its radius, surface composition, and evolutionary history. X-ray emission is predicted (and was observed in a single serendipitous case) from the brief shock breakout phase, and more extended emission may result from interaction of the SN ejecta with circumstellar material that we have shown often surrounds the exploding massive progenitors. The ability to survey wide sky areas rapidly and synchronously from ground (visible) and space (X-ray) promises very high scientific returns.

Presenter status

Primary author(s) :   Prof. GAL-YAM, Avishay (Weizmann Institute of Science)

Presenter(s) :   Prof. GAL-YAM, Avishay (Weizmann Institute of Science)

Session Classification :   Time domain and multi-messenger astronomy

Contribution ID : **45**   Type : **Oral Presentation**

The Hot Phase of the Interstellar Medium

Thursday, 19 March 2020 11:55 (20)

The interstellar medium (ISM) is heated and ionized by radiation, by stellar winds, and finally, by supernova explosions of massive stars. Since these processes are often correlated in space and time, they can form large interstellar structures called superbubbles, which are filled with hot thin plasma. Supernova remnants and superbubbles can be studied best in soft X-ray line and continuum emission, since the plasma in their interiors is very hot ($10^6 – 10^7$ K), while non-thermal particles accelerated in the shock waves can also cause X-ray emission. We will present recent results of studies of the hot ISM in the Milky Way and nearby galaxies, in particular in the Magellanic Clouds, and discuss the physics of the hot plasma, the evolution of supernova remnants and superbubbles, and the implications for the star formation history of the galaxies. We will also present first maps of the hot interstellar plasma in the LMC observed with eROSITA.

Presenter status

eROSITA consortium member

Primary author(s) :   SASAKI, Manami (Dr. Karl Remeis Observatory, University of Erlangen-Nurnberg); KNIES, Jonathan (FAU); Dr KAVANAGH, Patrick (Dublin Institute for Advanced Studies); HABERL, Frank; STRONG, Andy; MAITRA, Chandreyee (MPE); Dr FREYBERG, Michael (MPE)

Presenter(s) :   SASAKI, Manami (Dr. Karl Remeis Observatory, University of Erlangen-Nurnberg)

Session Classification : X-ray view of the Milky Way: SNe and the ISM

Contribution ID : **46**   Type : **Poster**

A comparison of the rapid decay stage in light curve of accreting neutron star and black hole transients

A large number of transient low mass X-ray binaries (LMXB) exhibit a knee in the decay stage of their light curves where the X-ray flux transits from a slow-decay stage to a rapid-decay stage. For the case of neutron stars, it had long been suggested that this sharp drop in the luminosity is due to transition from accretion to the propeller stage i.e.\ formation of a centrifugal barrier at low mass flux. Alternatively, it had been suggested that the knee is due to the ionization instability in the disk modulated by irradiation from the central source, a view which can address the knee in the lightcurve of both neutron star LMXBs and the galactic black hole transients (GBHT). In order to test the latter hypothesis, we have compared the dimensionless light curves of several BH and NS LMXB systems where the X-ray flux of each system is normalized with the knee flux and time is normalized with the outburst duration. The slopes of the exponential decay part of the dimensionless light curves of BH systems are much steeper than NS systems, implying that the underlying cause of the knee could be different in these systems.

Presenter status

Primary author(s) :   VAHDAT MOTLAGH, Armin (Istanbul Technical University)

Co-author(s) :   Prof. EKSI, K. Yavuz (Istanbul Technical University)

Presenter(s) :   VAHDAT MOTLAGH, Armin (Istanbul Technical University)

Contribution ID : **47**   Type : **Poster**

Infrared Colours and Spectral Energy Distributions of Hard X-ray Selected Compton-thick AGN

I will briefly review infrared properties of hard X-ray selected Compton-thick AGN from *Swift*-BAT 105-month survey catalogue. I will focus on the ultraviolet to far-infrared spectral energy distributions and present a mid-infrared colour selection criteria for heavily obscured AGN.

Presenter status

Primary author(s) :   Dr KILERCI-ESER, Ece

Co-author(s) :   Prof. GUVER, Tolga (Istanbul University); Dr GOTO, Tomogotsu (National Tsing Hua University); Ms TUNCER, Asli (Istanbul University); Mr ATAS, Oguz Han (Istanbul University)

Presenter(s) :   Dr KILERCI-ESER, Ece

Contribution ID : **48**   Type : **Oral Presentation**

XMM-Newton survey of star-forming galaxies in the local Universe: X-ray binary scaling relations

Wednesday, 18 March 2020 12:00 (15)

We present an analysis of the X-ray properties of all galaxies within a radius of 200 Mpc observed with XMM-Newton. These galaxies are the result of cross-correlation between the XMM-Newton archive and the HECATE catalogue, the most complete galaxy catalogue of the local Universe incorporating robust distances and stellar population parameters. In our analysis we use data from all objects observed by XMM-Newton (3041 galaxies). The sample spans 5 dex in star-formation rate and 4 dex in stellar mass and includes objects with no formal detections (i.e. upper limits). Furthermore, we perform detailed spectral fitting for all galaxies with adequate number of counts (1713 galaxies), in order to measure their spectral parameters and to identify the AGN in our sample. Using the largest X-ray sample of galaxies available so far, we measure the parameters of the linear relations between X-ray luminosity, star-formation rate, and stellar mass. We find a good agreement with previous works, but the great increase in the sample results in a larger scatter possibly due to age and metallicity differences of the stellar populations. This is an excellent reference sample for eROSITA surveys of normal galaxies as well as AGN. eROSITA will provide a truly unbiased sample for studies of galaxy scaling relations, which combined with the HECATE catalogue will allow us to derive the ultimate scaling relations for galaxies of different types and metallicity, measure their dependence on these parameters, and address the origin of the observed scatter.

Presenter status

Primary author(s) :   ANASTASOPOULOU, Konstantina (University of Crete/FORTH)

Co-author(s) :   Dr ZEZAS, Andreas (University of Crete); HABERL, Frank; Mr KOVLAKAS, Konstantinos (University of Crete/FORTH)

Presenter(s) :   ANASTASOPOULOU, Konstantina (University of Crete/FORTH)

Session Classification : X-ray emission from Galaxies

Contribution ID : **49**

Type : **Oral Presentation**

Treasures from the Zwicky Transient Facility Galactic Plane observations and its connection to eROSITA

Friday, 20 March 2020 12:00 (15)

The Zwicky Transient Facility (ZTF) started science operation in March 2018. 40% of ZTF observing time is dedicated to two public surveys: one covering the entire Northern sky every three nights in g and r passbands and one visiting the Galactic Plane every night in g and r. In addition to the public Galactic Plane survey, ZTF has conducted a dedicated high-cadence survey of selected Galactic Plane fields to study the ultra-short variable sky. So far we have covered about 4900 sqd. In this talk, I will present an overview of the ZTF Galactic Plane observations and present some science highlights from the first two years, including several new accreting binaries which are ideal for multi-wavelength studies with eROSITA. This includes the discovery of a new class of helium stars in accreting ultracompact binaries which are potential progenitors for Type Ia supernovae.

Presenter status

Primary author(s) :   Dr KUPFER, Thomas (KITP)

Presenter(s) :   Dr KUPFER, Thomas (KITP)

Session Classification :   Time domain and multi-messenger astronomy

Contribution ID : **50** Type : **Poster**

The Dynamic Infrared Sky

The dynamic infrared sky is only now starting to be explored. The infrared is key to understand elusive stellar fates that are opaque, cold or dusty. The infrared was key to unveiling the otherwise opaque heavy element nucleosynthesis in binary neutron star mergers. I will describe multiple projects to systematically chart the time-domain in the infrared and discuss possible synergies between jointly studying the X-ray and the infrared. I will begin with the ongoing SPitzer InfraRed Intensive Transients Survey (SPIRITS) and the newly commissioned 25 square degree Palomar Gattini-IR surveyor. We have also begun building WINTER - a new 1 sq deg yJH-band camera on a new 1m telescope at Palomar Observatory.

Presenter status

Primary author(s) : KASLIWAL, Mansi (California Institute of Technology)

Contribution ID : **51** Type : **Poster**

Long term X-ray variability study of AGN with Swift BAT light curves.

I will present results from a variability study of the Swift-BAT 105-month survey light curves. The variability analysis is based on the study of the normalized excess variance, as a function of luminosity and black hole mass, using the fully sampled light curves as well as 8-point sampled light curves over a period of 4 years, similar to what the light curves may look like for the eROSITA full sky survey, for the majority of the detected AGN. I will also present results from a power spectrum study of the most variable sources, using the fully sampled light curves. This analysis may be relevant to power spectrum analysis that can be done with the light curves that may result from the eROSITA sky survey data in small areas around the ecliptic poles.

Presenter status

Primary author(s) : Prof. PAPADAKIS, Iossif (University of Crete)

Contribution ID : **52**   Type : **Oral Presentation**

Binary X-ray source populations at different accretion stages

Thursday, 19 March 2020 16:35 (20)

We employ a binary population synthesis, combined with a detailed treatment of mass transfer onto neutron stars and black holes from the optical component with the help of the MESA stellar evolution code, to model populations of binary X-ray sources in galaxies. Wind-fed accreting neutron stars are calculated with taking into account different regimes of quasi-spherical accretion onto magnetised neutron stars (Bondi-Hoyle or settling subsonic, depending on the plasma cooling near the neutron star magnetosphere). Features of the supercritical disk accretion onto black holes and magnetised neutron stars are also taken into account. Our model enables us to reproduce the observed properties of specific X-ray binary types, including symbiotic X-ray binaries, Be-X-ray binaries and ultraluminous X-ray sources. We also model the X-ray luminosity function from different X-ray binary populations in galaxies with an account of the star formation rate history and metallicity evolution. The X-ray luminosity function can be used as a tool to study properties of X-ray binary populations observed in X-ray sky surveys.

Presenter status

Primary author(s) :   Prof. POSTNOV, Konstantin (Sternberg Astronomical Institute);   Dr KURA-NOV, Alexander (Sternberg Astronomical Institute);   Dr YUNGELSON , Lev (Institute of Astronomy RAS);   Mr KOLESNIKOV, Dmitry (Sternberg Astronomical Institute)

Presenter(s) :   Prof. POSTNOV, Konstantin (Sternberg Astronomical Institute)

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **54**   Type : **Oral Presentation**

X-ray emission from starburst dwarf galaxies: galactic winds and X-ray binaries

Wednesday, 18 March 2020 12:15 (15)

Low mass, low metallicity starburst galaxies are of special interest for galaxy evolution, since they are not only laboratories for massive star evolution and feedback at low metallicity, but also the extreme end of energy input into a galacitic potential. In many ways they are the best proxies for the z ~ 6 to 10 protogalaxies, which are inaccessible to detailed observational studies.

The observation of X-ray emission is crucial for understanding the workings in these dwarf starburst in two ways, firstly to map and analyze the properties hot gas in galactic outflows and winds, and secondly as hosts of a massive X-ray binaries population which contributes significantly to the radiation field in these galaxies. In this talk I will present results of XMM-Newton and Chandra analyses of local and intermediate redshift dwarf starburst galactic winds and X-ray binaries and put them into context with our new VLA and LOFAR on the importance of magnetic fields for the outflows and LBT spectroscopy on dwarf starbursts with very hard radiation fields.

I will also provide a outlook toward the use of eROSITA for the large scale mapping of hot gas of galactic winds and the impact of luminous X-ray binaries for the ionization field in low metallicity starburst galaxies.

Presenter status

Primary author(s) :   BOMANS, Dominik (Astronomical Institute of the Ruhr University Bochum)

Presenter(s) :   BOMANS, Dominik (Astronomical Institute of the Ruhr University Bochum)

Session Classification :   X-ray emission from Galaxies

Contribution ID : **55**   Type : **Poster**

The Gamow Explorer: A Gamma-Ray Burst Mission to Investigate the High Redshift Universe

Gamma Ray Bursts (GRBs) can be used to address key scientific questions on the formation of the Universe including: When did the star formation begin and how did it evolve? When and how did the intergalactic medium become re-ionized? What processes governed its early chemical enrichment? Long GRBs signal when a massive star collapses and provide a tracer of massive star formation. The GRB afterglow is a bright beacon lasting a few days that can be used out to the highest redshifts to probe the intervening material from the host galaxy and intergalactic medium. The Gamow Explorer will detect and locate GRBs from the z > 6 high redshift universe. A wide field X-ray telescope detects GRBs and triggers a rapidly slewing spacecraft to point an Infra-red telescope to obtain an arc second location and autonomously determine whether the redshift is greater than 6. For z>6 GRBs a redshift alert will enable follow up by large telescopes. The Gamow Explorer will be proposed to the 2021 NASA MIDEX opportunity, for launch in 2028. It will be a key component in the multi-messenger era of JWST, 30-m class telescopes and gravitational wave detectors.

Presenter status

Primary author(s) :   Prof. WHITE, Nicholas (George Washington University)

Co-author(s) :   BAUTZ, Mark (MIT); FALCONE, Abe (Penn State University); FELDMAN, Charly (University of Leicester); FOX, Derek (Penn State University); GHIRLANDA, Giancarlo (INAF Osservatorio Astronomico di Brera); Prof. KOUVELIOTOU, Chryssa (George Washington University); LAWRENCE, Charles (JPL); LIEN, Amy (University of Maryland Baltimore County and GSFC); O'BRIEN, Paul (University of Leicester); PALMER, David (LANL); ROMING, Peter (SWRI); WILSON-HODGE, Colleen (MSFC); YOUNG, Erick (USRA)

Contribution ID : **56**   Type : **Poster**

Algorithms relevant for X-ray imaging

I will describe several algorithms which are relevant for X-ray imaging surveys, including: an extension of the matched filter for data in the Poisson noise regime; Search for periodicity in the presence of red noise and its implications for reverberation mapping; and increasing the resolution using image coaddition.

Presenter status

Primary author(s) :   Prof. OFEK, Eran (Weizmann Institute)

Contribution ID : **57**   Type : **Oral Presentation**

The Changing-Look Zoo

Friday, 20 March 2020 10:30 (15)

Almost 200 changing-look AGN/quasars are currently known showing significant spectroscopic and photometric variability on timescales of months to years. Although initially discovered by serendipity, systematic searches of archival survey data, such as SDSS, Pan-STARRS, and CRTS, have identified such sources in significant numbers. Ongoing time domain sky surveys, such as ZTF, which cover the visible sky every few nights, are enabling real-time monitoring of such objects as they transition between different states of activity. However, the known set of changing-look sources spans a range of luminosity, black hole mass, and Eddington ratio and this suggests that a number of different physical mechanisms may be contributing to the same broad observed phenomenology. X-ray observations may well be the key to distinguishing between different models, particularly if contemporaneous with optical observations. In this talk, I will review the current state of the field, and consider how a joint ZTF-SRG data set will greatly improve our understanding of this phenomenon.

Presenter status

Primary author(s) :   Prof. GRAHAM, Matthew (Caltech); Dr STERN, Daniel (Caltech/JPL); Prof. MCKERNAN, Barry (AMNH/CUNY); Prof. FORD, Saavik (AMNH/CUNY); Dr ROSS, Nicholas (ROE, Edinburgh); Ms FREDERICKS, Sara (UMD); Prof. GEZARI, Suvi (UMD)

Presenter(s) :   Prof. GRAHAM, Matthew (Caltech)

Session Classification :   Time domain and multi-messenger astronomy

Contribution ID : **58**   Type : **Poster**

Calibration of the Low Energy Response of the eROSITA CCDs with 1E 0102.2-7219

We report on our efforts to use the data from 1E 0102.2-7219 to verify the low energy response model for the eROSITA CCDs. 1E 0102.2-7219 (hereafter E0102) is the X-ray brightest supernova remnant (SNR) in the Small Magellanic Cloud (SMC). E0102 has a line-rich spectrum that is dominated by emission from O, Ne, and Mg with very little or no Fe emission. The lack of Fe L shell emission makes E0102's spectrum particularly useful for the calibration of CCD-resolution instruments because line blending is minimized. The E0102 spectrum has been well-characterized by the RGS on XMM-Newton and the HETG on the Chandra X-ray Observatory. A standard spectral model has been developed by the International Astronomical Consortium for High Energy Calibration (IACHEC) and has been used by the current generation of X-ray instruments to improve their calibrations. We apply this model to the eROSITA data to investigate the gain, spectral redistribution function, and the detection efficiency. We compare the line fluxes for the OVII triplet, OVIII Ly-alpha, NeIX triplet, and the Ne X Ly-alpha line complexes to the current generation of instruments to determine the consistency of the absolute effective areas of the instruments at these energies.

Presenter status

Primary author(s) :   PLUCINSKY, Paul (SAO)

Co-author(s) :   Dr DENNERL, Konrad (MPE); Dr FREYBERG, Michael (MPE); Prof. SASAKI, Manami (ECAP); Dr HABERL, Frank (MPE)

Contribution ID : **59**   Type : **Poster**

MAXI discoveries of 29 new X-ray transients

MAXI has been observing all X-ray sky from the ISS for more than 10 years. Until the end of 2019, MAXI discovered 13 galactic black hole candidates,13 (or 12) neutron star binaies, 1 white dwarf binary and 2 (or 3) unidentified X-ray transients. The 13 black holes candidates show various brightness and spectral evolution, which enable us to constrain the masses and distances of the sources. The neutron star binaies discovered include a variety of low-mass and high-mass X-ray binaies:X-ray bursters, e.g., J1647-227 and J1621-501, a "very faint X-ray transient" J1957+032, a possible "Supergiant Fast X-ray Transient" J1932+091, and a 507 sec pulsar J1409-619. J0158-744 is thought to be the first detection of the ignition phase of the white dwarf nova. We also note that some these transeints MAXI discovered are located at high galactic latitudes, which gives a new insight of the binary population and the evolution theory. I review X-ray properties of the X-ray novae MAXI discovered and statistical study using MAXI GSC data.

Presenter status

Primary author(s) :   NEGORO, HITOSHI (Nihon University)

Session Classification :   Time domain and multi-messenger astronomy

Contribution ID : **61**   Type : **Poster**

Discovery and energy spectra of the new black hole binary MAXI J1631-479 observed with MAXI/GSC

A new transient source was discoverd on 2018 December 21 by MAXI (Kobayashi+ ATel \#12320). NuSTAR followup observations on December 28 revealed that the source was a new transient source, MAXI J1631-479, and the obtained 3-79 keV X-ray energy spectrum suggested that it was a black hole binary (Miyasaka+ ATel \#12340). After the discovery, the source brightened gradually. In the initial stage of the outburst, the 2-20 keV GSC spectrum was discribed by a power-law model with a photon index of ≤ 2. After December 25, the spectrum was discribed by a disk-blackbody plus power-law model. After 2019 January 7, the spectrum was dominated by a disk-blackbody component with a constant inner disk radius, and in a few days the 2-10 keV X-ray flux reached the peak value of about 2 Crab. After the peak flux, the source dimmed gradually, and made a transition to the hard (intermediate) state on January 23 (Negoro+ ATel \#12421), where the spectrum was discribed by a disk-blackbody plus power-law model. In March, it came back to the soft state again. On June 4, the source underwent a soft-to-hard transition, and the spectrum was dominated by a power-law component. If a soft-to-hard transion occurs at 1-4% of the Eddington luminosity (e.g., Maccarone 2003), the source distance is estimated at about 10 kpc for a 10 solar mass black hole.

Presenter status

Primary author(s) :   KOBAYASHI, Kohei (Nihon University)

Co-author(s) :   NEGORO, Hitoshi (Nihon University)

Contribution ID : **62**   Type : **Oral Presentation**

Low level accretion activity in X-ray binaries

Thursday, 19 March 2020 17:45 (15)

Low-mass X-ray binaries can lay dormant, remaining undetected for decades, until they are usually detected by X-ray monitoring satellites when they undergo bright outbursts. However, during these periods of quiescence between outbursts, low level accretion does occur but usually cannot be studied at X-ray energies due to their extremely low fluxes. We have been monitoring ~40-50 X-ray binaries with the Faulkes Telescopes / Las Cumbres Observatory (LCO) global robotic network for more than a decade. We find evidence for low level, variable accretion activity, long-term trends and jets being launched at 10^{-6} - 10^{-8} times the Eddington luminosity in some systems. Different activity states exist in quiescence. The X-ray spectra of quiescent X-ray binaries are described by a power law; different sources have slightly different spectra. eROSITA on SRG will achieve high S/N soft X-ray spectra of Galactic quiescent low-mass X-ray binaries. We wish to test if accretion activity (identified by our optical monitoring) correlates with the X-ray properties uncovered by eROSITA. I will also introduce our new real-time optical monitoring pipeline, the "X-ray Binary New Early Warning System (XB-NEWS)", which aims to detect and announce new X-ray binary outbursts within a day of first optical detection. We are now detecting the early stages of these outbursts with our optical telescopes, before they become bright enough for X-ray detection. This allows us to trigger X-ray and multi-wavelength campaigns during the very early stages of outbursts, to constrain the outburst triggering mechanism.

Presenter status

Primary author(s) :   RUSSELL, David (New York University Abu Dhabi)

Presenter(s) :   RUSSELL, David (New York University Abu Dhabi)

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **63**   Type : **Poster**

X-ray properties of the blue clusters discovered with the Subaru/HSC

It is known that the fraction of blue galaxies in galaxy clusters increases with increasing redshift, suggesting that star formation in the galaxy clusters has decayed rapidly over cosmic time (Butcher & Oemler 1984). Nearby groups of galaxies often show the anti-correlation between the blue fraction of member galaxies and their X-ray luminosities (Mulchaey 2003; Ota et al. 2004). However, whether or not this anti-correlation is applicable to distant galaxy clusters is still unclear. To understand the dependence of blue fraction on X-ray luminosity and co-evolution of galaxies and hot intracluster gas, we investigate the gas properties of the blue clusters. In this work, we present an analysis of XMM-Newton observations of 43 blue galaxy clusters at z = 0.84 discovered with the Hyper Suprime-Cam (HSC) on the Subaru Telescope. The sample is drawn from galaxy clusters selected with the Hybrid Search for Cluster with HSC (HSC-HSC) survey. Based on the HSC-HSC cluster catalog and XMM-Newton archival data, we estimate X-ray luminosities of 43 blue clusters. As a result, 13/43 clusters are detected by XMM-Newton, and their average X-ray luminosity is $L_x(0.5\text{-}2\,\mathrm{keV}) = (6.8 \pm 0.7) \times 10^{42}\,\mathrm{erg\,s^{-1}}$. Because AGNs exist in 7/43 clusters, their X-ray luminosities may be affected by AGN emission. We compare our results with those of red clusters and discuss the evolutionary stage of intracluster gas in the blue clusters.

Presenter status

Primary author(s) :   MISATO, Rana (Nara Women's University)

Co-author(s) :   OTA, Naomi (AIfA);   TOBA, Yoshiki (Kyoto University)

Presenter(s) :   MISATO, Rana (Nara Women's University)

Contribution ID : **64**   Type : **Poster**

The Next Generation X-ray Galaxy Survey with eROSITA

We present our simulations and predictions for eROSITA's potential contributions to the study of X-ray emission from normal (i.e., not AGN) galaxies. We start from multiwavelength catalogues, including ultraviolet, optical, and infrared data, to measure star formation rates and stellar masses for 60,212 galaxies constrained to distances of 50-200 Mpc. This distance range was chosen to focus on the relatively unexplored volume outside the more local Universe, which will be largely spatially unresolved and will represent a statistically significant new sample of X-ray detected galaxies. Using updated X-ray scaling relations, we predict the X-ray emission from XRBs and diffuse hot gas. Additionally, we include potential contributions from hidden AGN. In this presentation, I will discuss the galaxies that eROSITA will likely detect, based on the expected 4-year sensitivity limits and survey capabilities of this telescope and summarize the distribution of morphological types and the relative contribution of X-ray emission from HMXBs, LMXBs, and hot gas. Based on our conservative approach, we estimate that the eROSITA 4-year survey will detect ~16,000 galaxies (3 sigma significance) at 50-200 Mpc over the full sky, which is ~100X more normal galaxies than detected in any X-ray survey to date. The significantly increased sample will enable statistical studies to explore the underlying physics of the X-ray emission, i.e, the evolution of X-ray binaries and hot ISM in galaxies.

Presenter status

Primary author(s) : BASU-ZYCH, Antara (NASA GSFC/UMBC); HORNSCHEMEIER, Ann (NASA GSFC); VULIC, Neven (University of Maryland College Park/NASA GSFC); HABERL, Frank; Dr ZEZAS, Andreas (University of Crete); Dr PTAK, Andrew (NASA GSFC); Mr KOVLAKAS, Konstantinos (University of Crete/FORTH); WILMS, Joern; DAUSER, Thomas

Presenter(s) : BASU-ZYCH, Antara (NASA GSFC/UMBC)

Contribution ID : **65**   Type : **Poster**

Synergies between Chandra and eROSITA

The eROSITA instrument, onboard of the Russian-German Spectrum-Roentgen-Gamma (SRG) satellite, will image the entire sky in X-rays. The superb sensitivity of the resulting eROSITA All-Sky Survey (eRASS) will enable pioneering discoveries in many fields of astrophysics. Most notably, the eRASS will detect a vast number of galaxy clusters and active galactic nuclei both in the nearby and in the high redshift Universe. To carry out a thriving science program, it is essential to build a synergy between eROSITA and other ground-based and space-based telescopes. In this presentation, we will discuss Chandra X-ray Observatory follow-up observations of eROSITA-identified sources with particular focus on studies of galaxy clusters and active galactic nuclei. We will highlight science programs, utilizing the sub-arcsecond angular resolution of Chandra for follow-up observations, which will provide a definitive edge and lead to ground-breaking discoveries. In addition, we will present the initial results of the first Chandra follow-up observations of eROSITA targets identified during the Performance Verification phase.

Presenter status

Primary author(s) :   BOGDAN, Akos (Center for Astrophysics | Harvard & Smithsonian (CfA))

Co-author(s) :   Dr KRAFT, Ralph (Center for Astrophysics | Harvard & Smithsonian (CfA)); Dr SU, Yuanyuan (University of Kentucky); Dr FORMAN, William (Center for Astrophysics | Harvard & Smithsonian (CfA)); Dr JONES, Christine (Center for Astrophysics | Harvard & Smithsonian (CfA))

Contribution ID : **66**
Type : **Poster**

Eddington-limited soft X-ray emission produced by optically thick outflow from supercritical accretion

Radiation-driven, optically thick outflows are predicted to launch in X-ray binaries or quasars when the accreting rates are super-Eddington. The optically thick outflows would thermalize the radiation to a blackbody-like emission with a cool temperature $kT_{\rm bb} <\sim 0.4\ keV$. The bolometric luminosity of the soft thermal emission is also predicted to limit around one Eddington luminosity by supercritical wind models.Hence the luminosity of soft emission could be an indicator to the mass of the compact object. Soft emissions in excess of a single power-law spectra are commonly seen in ultraluminous X-ray sources (ULXs), which is considered to be from the supercritical winds. However, robust observational evidence is lacked. In this talk, I will show our study on the soft emission of 20 luminous ULXs, and the connection between the soft emission and the supercritical winds. We fit the high-quality XMM-Newton/EPIC spectra with a thermal blackbody component plus a physical Comptonized component. We find that the bolometric luminosities of the black-body component ($L_{\rm bb}$) are constant among multiple epoch observations for some ULXs, such as NGC 1313 X-1 and M51 X-8, even through their total X-ray luminosities are significantly variable. More interesting, the $L_{\rm bb}$ distribution of the 20-ULX sample is bimodal, with $L_{\rm bb} <\sim 10^{39}$ erg s^{-1} for all the confirmed neutron star ULXs (except for M51 X-7), and with $L_{\rm bb} >\sim 10^{39}$ erg s^{-1} for all the other unknown compact object ULXs. While the latter are more likely to be black hole ULXs. The results shows that luminosities of the soft emissions are basically around the Eddington limit within one order of magnitude, and the model-predicted accretion rates are ~ 100 times of the Eddington rate. This demonstrate that the soft excess emission in our ULX sample are highly consistent with the prediction of the supercritical models, that the soft emission is produced by the optically thick outflow from super-Eddington accretion.

Presenter status

Primary author(s) : Dr YANLI, Qiu (Tsinghua University)

Co-author(s) : Prof. HUA, Feng (Tsinghua University)

Presenter(s) : Dr YANLI, Qiu (Tsinghua University)

Contribution ID : **67**   Type : **Poster**

Modelling the cosmological foregrounds

Studies of the cosmological backgrounds are approaching the very technological limits of our present day instrumentation capabilities. But already today the systematic uncertainties exceed the statiscal ones. Simply, because our actual knowledge of the Milky Way foregrounds is not sufficient. We need to quantify precisely the essential quantity, the density distribution of hydrogen nucleons along the line of sight. Independent of its physical state of ionized, neutral or molecular. Cross correlation studies of full sky surveys comprising soft X-ray (E < 0.4 keV), far-infrared and HI 21-cm line measurements provide a powerful tool to disentangle the contribution of these different gaseous phases of the hydrogen nuclei. In this context the *eROSITA* mission is becoming a crucial role for multi-frequency studies of the early universe. Here, we demonstrate the quantitative modelling to the hydrogen nuclei density towards the high galactic latitude sky, allowing to probe the cosmological background at an unsurpassed accuracy level.

Presenter status

Primary author(s) :   Dr KERP, Juergen (Argelander-Institut fuer Astronomie, Bonn University)

Co-author(s) :   Dr WINKEL, Benjamin (Max-Planck-Institut fuer Radioastronomie); Dr KALBERLA, Peter (Argelander-Institut fuer Astronomie, Bonn University);   Dr HAUD, Urmas (Tartu Observatory, University of Tartu)

Presenter(s) :   Dr KERP, Juergen (Argelander-Institut fuer Astronomie, Bonn University)

Contribution ID : **69** Type : **Oral Presentation**

All-sky X-ray maps with MAXI/SSC

Wednesday, 18 March 2020 12:50 (15)

We will present diffuse X-ray background maps obtained with Solid-state Slit Camera (SSC) on board the MAXI mission for 2 years from 2009 to 2011, in energy bands of 0.7-1.0, 1.0-2.0, and 2.0-4.0 keV (arXiv:1912.01572). They are the first ones that were derived with a solid-state instrument, and to be compared with the previous ROSAT all sky survey result. While the SSC map in the highest energy band is dominated by point sources and the Galactic Diffuse X-ray emission, that in 0.7-1.0 keV reveals an extended X-ray structure, of which the brightness distribution is very similar to that observed with ROSAT about 20 years before. The SSC map suggests a fainter and larger ellipse, which is elongated in the north-south direction and roughly centered at the Galactic center. The spectrum of these structures is explained as thin thermal emission from a plasma, with a temperature of ~0.31 keV and an abundance of ~0.3 Solar. Based on SSC observation conditions including the low Solar activity, the Solar Wind Charge Exchange signals are estimated to be negligible in the present SSC maps, as well as in the >0.56 keV ROSAT map.

Presenter status

Primary author(s) : NAKAHIRA, Satoshi (ISAS/JAXA)

Co-author(s) : Dr TSUNEMI, Hiroshi (Osaka University); Dr TOMIDA, Hiroshi (ISAS/JAXA); Dr NAKASHIMA, Shinya (RIKEN); Dr KATAOKA, Ryuho (National Institute of Polar Research); Dr MAKISHIMA, Kazuo (Kavli IPMU)

Presenter(s) : NAKAHIRA, Satoshi (ISAS/JAXA)

Session Classification : X-ray emission from Galaxies

Contribution ID : **70**   Type : **Poster**

Probing the AGN Torus with Self-consistent Multi-epoch Broadband X-ray Spectroscopy

Active galactic nuclei (AGN) are known to be variable in many respects and across many timescales. In order to probe the geometry of AGN and better understand their overall variability it is important to disentangle spectral components corresponding to the different structures surrounding the central supermassive black hole (SMBH). In the X-ray band, the main contributors to spectral variability are the coronal continuum, variations in the line-of-sight absorption, and reprocessing in the accretion disk, in the broad-line region and in the torus. Because of their different spatial scales, they vary and correlate with the coronal continuum on different timescales. I will present the principles of self-consistent multi-epoch broadband spectral modeling that helps to constrain spectral parameters better than the simpler and commonly used analysis of multiple epochs using a single-epoch model in each one of them. This approach can maximize the return from repeated observations of bright local AGN with eROSITA and further our understanding of the AGN torus in particular.

Presenter status

Primary author(s) :   BALOKOVIC, Mislav (Center for Astrophysics | Harvard & Smithsonian)

Presenter(s) :   BALOKOVIC, Mislav (Center for Astrophysics | Harvard & Smithsonian)

Contribution ID : **71**   Type : **Poster**

The spatial distribution of circumstellar material of the wind-fed system GX 301-2

The distribution of the circumstellar material in systems of supergiant X-ray binaries (SgXBs) is complex and not well probed observationally. We report a detailed study of the spatial distribution of the Fe Kα-emitting material in the wind-fed system GX 301-2, by measuring the time delay between the Fe Kα line and the hard X-ray continuum (7.8–12 keV) using the cross-correlation method, based on XMM-Newton observation. We found that to obtain the true time delay, it is crucial to subtract the underlying continuum of the Fe Kα line. The measured size of the Fe Kα-emitting region over the whole observation period is 40 ± 20 light-seconds. It is 5 times larger than the accretion radius estimated from a quasi-isotropic stellar wind, but consistent with the one estimated from a tidal stream, which could be the dominant mass-loss mechanism of GX 301-2 as inferred from the orbital distribution of the absorption column density previously. The measured time delay of the quiescent period is a little smaller than those of the flare periods, revealing the unsteady behaviour of the accretion flow in GX 301-2. Statistical and detailed temporal studies of the circumstellar material in SgXBs are expected for a large sample of SgXBs with new X-ray missions.

Presenter status

Primary author(s) :   Ms ZHENG, Xueying (National Astronomical Observatories, Chinese Academy of Sciences);   LIU, Jiren (National Astronomical Observatories, Chinese Academy of Sciences);   Prof. GOU, Lijun (National Astronomical Observatories, Chinese Academy of Sciences)

Contribution ID : **72**   Type : **Poster**

Heavily-Obscured X-ray AGNs shed Light on the Connection between the Quenching of M* Galaxies and the Cosmic Web

Well documented up to redshift z ~ 4, the bimodality between "blue/star-forming" (SF) and "red/quiescent" (Q) galaxies is the statistical expression of the so-called *quenching* of the star formation. On the other hand, the diversity observed among quiescent galaxies (e.g., in terms of mass or morphology) suggests that the mechanisms involved in the quenching are multiple. For instance, the processes that are at play in the quenching of low-mass galaxies may be quite different from those involved in the quenching of massive galaxies, after billion years on the star formation main sequence (Faber et al. 2007, Schawinski et al. 2014, Moutard et al. 2016b).

In particular, the fact that star formation is observed to stop earlier in more massive galaxies, on average, underlies a downsizing of the quenching that argues for the existence of mass-related quenching processes, and the stellar mass function of SF galaxies shows that such "mass quenching" operates in galaxies with stellar mass reaching the characteristic mass $M^* \sim 10^{10.6} M_\odot$ (Ilbert et al. 2010, Peng et al. 2010, Moutard et al. 2016b). While M^* galaxy quenching has been shown to be quite slow (lasting 1–3.5 Gyrs; e.g., Moutard et al. 2016b, Pandya et al. 2017), several mechanisms able to halt the cold gas supply have been put forth, e.g., due to the heating of the gas via viral shocks within dark-matter halos reaching a critical mass of $M_h \sim 10^{12} M_\odot$ (e.g., Kereš et al. 2005) or via radio-loud active galactic nucleus (AGN) feedback (e.g., Best et al. 2005).

I will present the results we obtained regarding the connection between the quenching of the star formation in evolved and massive galaxies and the presence of radio-loud and X-ray AGNs, by taking advantage of the rest-frame NUV-r vs. r-K colour (or NUVrK) diagram to unambiguously identify M^* quenching galaxies that are in transition in the so-called *green valley* between SF and Q galaxies.

I will first show that radio-loud AGNs are mostly hosted by already quenched and massive ($M_* > 10^{11} M_\odot$) galaxies, which tends to confirm that their feedback **is not** the primary cause for M^* galaxy quenching, as suggested previously (e.g., Hickox et al. 2009). More interestingly, I will then discuss the fact that the X-ray AGNs suffering from heavy obscuration of their soft X-ray emission are mostly hosted by M^* galaxies that in the process of quenching, which argues for a quenching scenario that involves mergers of (gas-poor) M^* galaxies **after** the onset of the quenching process, i.e., a scenario where M^* galaxy mergers **are not** the cause but rather an aftermath of the quenching process. I will finally discuss how this is consistent with a picture where M^* galaxy quenching happens along cosmic filaments.

Presenter status

Primary author(s) :   Dr MOUTARD, Thibaud

Presenter(s) :   Dr MOUTARD, Thibaud

Contribution ID : **73**   Type : **Poster**

The imprint of X-ray photoevaporation of planet-forming discs on the orbital distribution of giant planets

Recent exoplanet surveys have highlighted the existence of an impressive diversity of planetary systems, raising the question of how systems similar to our own can form and develop. The key to explaining the diversity of planetary systems is in the understanding of the statistical trends that are emerging from the recent wealth of exoplanet data. One of these is the non-uniform distribution of the semi-major axes of gas giants. Giant planets are found to preferentially clump up at orbital radii of ~1-2 au and finding what determines this peak is of strong interest. It has recently been suggested that this distribution may be established during the time of planetary migration in the protoplanetary disc, being halted by X-ray driven photoevaporation (Ercolano & Rosotti, 2015). We have searched for signatures of this process by correlating the X-ray luminosity of host stars with the semi-major axis distribution of their giant planets. Our statistical analysis of the observational data confirms a prominent feature that is also predicted by simulations, further strengthening the conclusion that X-ray photoevaporation may be shaping the architecture of planetary systems.

Presenter status

Primary author(s) :   MONSCH, Kristina (LMU Munich)

Presenter(s) :   MONSCH, Kristina (LMU Munich)

Contribution ID : **74**   Type : **Poster**

Multiphase gas in the intracluster medium

Galaxy clusters are the most massive reservoirs of X-ray emitting hot gas and the latter constitutes the largest fraction of the volume filling baryons in the intracluster medium. Observations indicate that the ICM does not cool as efficiently as predicted in the theory including pure radiative cooling. Combining radio, X-ray and Hα observations, it is now well known that the central black hole is injecting a copious amount of energy in clusters to maintain a rough global thermal balance at low redshifts. Using results from theory and idealized numerical simulations, I will discuss how locally thermally unstable ICM becomes multiphase (temperature ranges:$10^4 - 10^7$ K). I will also discuss how the radial extent of the entropy core in the hot gas may modify the nature of multiphase condensation. Although the metallicity is broadly uniform in clusters across $\sim$ 100s of kpc and redshifts, I will conclude my talk with a discussion on whether local metallicity fluctuations may affect multiphase condensation or not.

Presenter status

Primary author(s) :   Dr PALCHOUDHURY, Prakriti

Presenter(s) :   Dr PALCHOUDHURY, Prakriti

Contribution ID : **75**   Type : **Poster**

Noncool Core Galaxy Clusters and the Feedback from Their Central Active Galactic Nuclei

The study of the brightest cluster galaxy (BCG) coronae of noncool core (NCC) galaxy clusters and their central active galactic nuclei (AGN) is crucial for understanding the BCG's role on galaxy cluster evolution, as well as the activation of the self-regulated cooling and heating mechanism in the central regions of galaxy clusters. In this talk, I will present the X-ray properties of the intracluster medium (ICM) of a selected sample of NCC galaxy clusters from HIFLUGCS, and their BCG interstellar medium (ISM), along with their central AGN by using archival XMM-Newton and Chandra observations. The methods proposed in this work may have important implications on systematic SRG data analysis of the classification of galaxy clusters, and of the central AGN impact on the formation of large scale cool cores.

Presenter status

Primary author(s) :   Dr TUMER, Aysegul (The University of Utah, USA)

Co-author(s) :   Dr WIK, Daniel R. (The University of Utah);   Prof. ERCAN, E. Nihal (Bogazici University)

Presenter(s) :   Dr TUMER, Aysegul (The University of Utah, USA)

Contribution ID : 76   Type : **Oral Presentation**

ACCRETION HISTORY OF AGN: X-RAY POPULATION SYNTHESIS MODEL & MULTIWAVELENGTH PHOTOMETRIC REDSHIFTS

Monday, 16 March 2020 15:55 (15)

As matter accretes onto the central supermassive black holes in active galactic nuclei (AGNs), X-rays are emitted. We present a population synthesis model that accounts for the summed X-ray emission from growing black holes; modulo the efficiency of converting mass to X-rays, this is effectively a record of the accreted mass. We need this population synthesis model to reproduce observed constraints from X-ray surveys: the X-ray number counts, the observed fraction of Compton-thick AGNs [log (N_H/cm-2) > 24], and the spectrum of the cosmic X-ray background (CXB), after accounting for selection biases. Over the past decade, X-ray surveys by XMM-Newton, Chandra, NuSTAR, and Swift-BAT have provided greatly improved observational constraints. We find that no existing X-ray luminosity function (XLF) consistently reproduces all these observations. We take the uncertainty in AGN spectra into account and use a neural network to compute an XLF that fits all observed constraints, including observed Compton-thick number counts and fractions. This new population synthesis model suggests that, intrinsically, 50% ± 9% (56% ± 7%) of all AGNs within z ⍰ 0.1 (1.0) are Compton-thick.

Presenter status

Primary author(s) :   Dr ANANNA, Tonima Tasnim (Dartmouth College)

Presenter(s) :   Dr ANANNA, Tonima Tasnim (Dartmouth College)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : 77   Type : **Oral Presentation**

The hot gas at the edge of galaxy clusters and beyond: from simulations to X-ray observations

Tuesday, 17 March 2020 12:05 (15)

The properties of the hot medium at the periphery of galaxy clusters and in filaments connecting cosmic structures carries crucial information on their accretion history and on the feedback and enrichment processes from galaxies. In order to study the details of these processes and the three-dimensional structure of the diffuse baryons in clusters and cosmic filaments we resort to large cosmological hydrodynamical simulations, whose predictions can be directly compared against observational data.

We focus in particular on multiple systems of interacting galaxy clusters, obtained from light-cones extracted from the Magneticum simulation suite. I will discuss preliminary results and comparisons with observations of real systems, such as the A3391/95 pair observed with eRosita, by means of realistic mock eRosita observations generated from the simulated candidates. With this strategy, we aim at constraining the l.o.s. structure of similar systems from the X-ray properties, as well as the thermo-dynamical and chemical features of the gas between the member clusters.

Such realistic study of mocks from simulations is a fundamental complementary step given the large statistics provided by the eRosita survey, that can possibly lead to the identification of other candidates and to the study of the low surface-brightness gas at cluster boundaries and in filaments/bridges via stacking analyses.

Presenter status

Primary author(s) : BIFFI, Veronica (University Observatory Munich (Germany))

Co-author(s) : Dr DOLAG, Klaus (LMU)

Presenter(s) : BIFFI, Veronica (University Observatory Munich (Germany))

Session Classification : Clusters and Cosmology I

Contribution ID : **78**   Type : **Oral Presentation**

The NEP hard X-ray survey with ART-XC

Monday, 16 March 2020 17:40 (15)

The Astronomical Roentgen Telescope X-ray Concentrator (ART-XC) instrument onboard the Spectrum Röntgen Gamma (SRG) mission has started the all-sky hard X-ray survey since 2019/12/08. The observations of the ecliptic pole regions will reach exceptional depth thanks to the survey design of overlapping exposure in these regions. In anticipation of the ART-XC survey in the North Ecliptic Pole (NEP) region, we explore publicly available multiwavelength catalogs in the NEP region and investigate AGN candidates that might exhibit hard X-ray signals that will be detected by ART-XC. To capitalize on the ART-XC coverage in the NEP region, we also investigate ART-XC cadence and sensitivity limits for a selected few luminous X-ray sources. Comparisons between our simulations and the ART-XC survey in NEP will also be discussed.

Presenter status

Primary author(s) :   Dr CHIEN-TING, Chen (NASA MSFC/USRA)

Co-author(s) :   Dr SWARTZ, Douglas (NASA MSFC/USRA); Dr EHLERT, Steven (NASA MSFC); Dr KRIVONOS, Roman (IKI); MEREMINSKIY, Ilya (IKI); Dr PAVLINSKY, Mikhail (IKI); Dr TKACHENKO, Alexey (IKI)

Presenter(s) :   Dr CHIEN-TING, Chen (NASA MSFC/USRA)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : **79**   Type : **Oral Presentation**

SRGz: cross-match, photometric classification and probabilistic photo-z measurements for X-ray sources in the SRG surveys

Monday, 16 March 2020 16:10 (15)

We present SRGz - a programming package for doing effective optical cross-match, photometric classification and probabilistic photo-z measurements of SRG extragalactic sources. SRGz is based on competitive empirical machine learning (ML) algorithms: quantile random forest, gradient boosting, deep neural networks. ML-models were trained on SDSS spectral samples of quasars, galaxies and stars and samples of optical sources in the vicinity of X-ray sources from XMM-Newton Serendipitous Source Catalog and can provide accurate photometric prior probabilities for optical counterparts of SRG sources detected during the all-sky survey, their STAR/QUASAR/GALAXY classification scores and photometric redshifts in various forms (photo-z point predictions, confidence intervals and full probability distribution functions PDZ). The proposed methods allow one to precisely identify optical counterparts for the majority of X-ray sources in the SDSS footprint and accurately measure their redshifts with low fraction of catastrophic outliers. Quality of optical cross-match and photo-z prediction models were intensively tested on the spectroscopic X-ray samples in the Stripe82X and XMM-XXL-N extragalactic fields.

Presenter status

eROSITA/RU consortium member

Primary author(s) : Dr MESHCHERYAKOV, Alexander (IKI)

Presenter(s) : Dr MESHCHERYAKOV, Alexander (IKI)

Session Classification : AGN Surveys and the history of accretion

Contribution ID : **80**   Type : **Poster**

Cosmology and galaxy cluster scaling relations

Galaxy clusters are the most massive gravitationally bound objects in the universe, forming the nodes of the cosmic web. The imprint of structure formation is carried by the galaxy cluster number density and spatial distributions of galaxy clusters. Hence, these cluster properties are sensitive to the underlying cosmological model. Specifically, the abundance of galaxy clusters with mass and redshift is a well-known cosmological probe. With the successful launch of eROSITA, which is to conduct a deep all sky X-ray survey out to redshift ~1.5 and is expected to detect ~100,000 clusters, the constraints on cosmology using galaxy clusters are expected to be more precise. To this end, better understanding of the associated biases, selection effects, and scaling relations is very important.

The cluster mass is a key parameter for studies that aim to constrain cosmological parameters using galaxy clusters. It is therefore critical to understand and properly calibrate scaling relations between observables like the cluster X-ray temperature and the mass of the cluster. The parameters of the underlying scaling relation model can be fit directly to the observed data but, they need to be simultaneously fit together with parameters describing the cosmological model. Here, we use simulations to create samples of clusters with associated observables like the X-ray photon counts, temperature, and luminosity in a given energy band in the observer frame. We then try to find an optimal observable for calibration of the observable-mass scaling relation. Establishing the scaling relation also provides a way to constrain the cosmological parameters like the matter density parameter. This improved observable will be useful for getting more accurate results and understanding better, the large-scale properties of clusters and their use in cosmology.

Presenter status

Primary author(s) :   PALIWAL, Aishwarya (Argelander-Institut für Astronomie, University of Bonn);   REIPRICH, Thomas H. (AIfA, University of Bonn);   PACAUD, Florian (AIfA, University of Bonn)

Co-author(s) :   NEMANI, Lavanya (INAF - Osservatorio Astronomico di Roma)

Presenter(s) :   PALIWAL, Aishwarya (Argelander-Institut für Astronomie, University of Bonn)

Contribution ID : **81** Type : **Oral Presentation**

X-ray signatures of black hole feedback: theory confronts observations

Wednesday, 18 March 2020 09:30 (15)

State-of-the-art cosmological simulations of galaxies and galaxy clusters, such as IllustrisTNG (www.tng-project.org), suggest a scenario whereby the quenching of star formation in massive galaxies is caused by gas removal from the central regions of galaxies, in addition to gas heating, because of the activity of super massive black holes. The IllustrisTNG project comprises a series of large-volume cosmological simulations where gravity, magnetohydrodynamics and prescriptions for star formation, stellar evolution, metal enrichment, cooling and heating of the gas, galactic outflows and feedback from the supermassive black holes (SMBHs) are all taken into account within the LCDM paradigm. In practice, in these simulations, with one unique set of physical ingredients, we simultaneously resolve and model the inner structural details of thousands of galaxies across 5 orders of magnitude in stellar mass, across environments, and together with the evolution and dynamics of the inter-stellar, circum-galactic and inter-galactic media. The phenomena emerging from the underlying effective theory for galaxy formation include an observationally-consistent separation of star-forming and quenched galaxies across a wide range of observables across cosmic epochs. In this talk, I will focus on a specific, quantitative prediction by IllustrisTNG and its test against observational data. On the one hand, according to the IllustrisTNG simulations, star-forming and quiescent galaxies exhibit markedly distinct X-ray luminosity vs. K-band magnitude relations. In particular, the IllustrusTNG simulations predict a clear X-ray luminosity separation between star-forming and quiescent galaxies at $M\_K \sim -24$, corresponding to stellar masses of $10^{10.5-10.7}$ solar masses, with star-forming galaxies being X-ray brighter than their quenched counterparts, by up to two orders of magnitudes (Truong, Pillepich et al. 2019). The difference is more prominent within the central regions ($< Re$) than at larger radii ($<5Re$) and it is qualitatively broadly consistent with currently available X-ray data of late and early-type galaxies in the local Universe. On the other hand, –if everything goes fine – I will use data collected by eROSITA during the Science Verification phase and targeting galaxies from the Hyper Suprime Camera surveys with Subaru to perform more robust and extensive tests for the L_X dichotomy predicted insofar and hence to further probe the quenching mechanism in the Universe.

Presenter status

Primary author(s) : PILLEPICH, Annalisa (MPIA Heidelberg)

Presenter(s) : PILLEPICH, Annalisa (MPIA Heidelberg)

Session Classification : AGN and their host galaxies

Contribution ID : **82**   Type : **Poster**

Cosmological constraints from CODEX galaxy clusters spectroscopically confirmed by SDSS-IV SPIDERS DR16

We present a cosmological analysis based on the properties of X-ray selected clusters of galaxies from the CODEX survey, which have been spectroscopically validated as part of the SPIDERS programme within SDSS DR16. The sample contains a total of 2740 clusters over an area of $5,300\mathrm{deg}^2$, making it the largest spectroscopic cluster catalogue ever constructed. Optical richness is used as a proxy for the cluster mass, and the combination of X-ray, optical and spectroscopic information ensures that only confirmed virialised systems are considered. Clusters are binned in redshift, $z \in [0.1, 0.6)$ and optical richness, $\lambda \in [20, 244)$ and the counts in each bin are modelled as a function of cosmological and scaling relation parameters. A high-purity sub-sample of 1017 clusters is used in the fiducial analysis and best fit cosmological parameters are found to be $\Omega_0 = 0.31^{+0.04}_{-0.03}$ and $\sigma_8 = 0.72^{+0.03}_{-0.03}$. These results are consistent with previous measurements in the literature and the precision is comparable to other state-of-the-art cluster cosmology experiments.

Presenter status

Primary author(s) : Mr IDER CHITHAM, Jacob (MPE); COMPARAT, Johan (MPE); FINOGUENOV, Alexis (University of Helsinki); CLERC, Nicolas (IRAP); KIRKPATRICK, Charles (University of Helsinki); DAMSTED, Sanna (University of Helsinki); KUKKOLA, Antti; CAPASSO, Rafaela (University of Stokholm); NANDRA, Paul (MPE); MERLONI, Andrea (MPE); BULBUL, Esra (MPE); SCHNEIDER, Donald (Pennsylvania State University); BROWNSTEIN, Joel (University of Utah)

Presenter(s) : Mr IDER CHITHAM, Jacob (MPE)

Contribution ID : **83**   Type : **Poster**

Understanding Early Type Galaxies, their Stellar Masses, SMBHs, and Dark matter Halos with eRosita

Optically luminous early type galaxies inhabit dense environments and host X-ray luminous, hot atmospheres. At fainter optical magnitudes, as the dark matter halos decrease in mass, the energy input into the hot atmospheres is likely able to drive galactic winds and expel much of the hot gas that accumulates from stellar mass loss or remains from earlier epochs of galaxy formation. In addition, there are a very few examples of galaxies which are unusually X-ray luminous with large dark matter halo masses and large SMBHs but have small optical luminosities (i.e., NGC4342 and NGC4291). These properties suggest that, in some galaxies, star formation can be truncated at early times, breaking the simple scaling relations. Current X-ray galaxy samples are very biased toward more massive (more luminous) systems. eRosita will provide an unprecedented view of the early type galaxy population. In addition, eRosita will enable "stacking" of all subtypes of early type galaxies to probe to fainter optical luminosities (and hence halo masses; assuming a correlation between stellar mass and halo mass, for most galaxies). We will discuss the current state of early type galaxy samples and eRosita's impact for understanding the atmospheres of early-type galaxies, feedback from SMBHs, and the formation of the stellar mass component of early type galaxies at the time of star formation.

Presenter status

Primary author(s) :   Dr FORMAN, William (Smithsonian Observatory/CfA); Dr JONES, Christine (SAO-CfA)

Contribution ID : **84**   Type : **Oral Presentation**

Comparing Hydrostatic and Dynamical Masses of Clusters of Galaxies

Tuesday, 17 March 2020 10:20 (15)

Accurate and precise mass measurements of clusters of galaxies are critical for constraining cosmology with cluster number counts from eROSITA. Much progress has been made in measuring cluster masses from X-rays (assuming hydrostatic equilibrium), weak gravitational lensing, and galaxy dynamics, but systematic differences between the methods still remain at the tens of percent level. We will present the largest comparison between cluster masses determined from X-ray hydrostatic analyses and galaxy dynamics using the caustic method. In a sample of 44 galaxy clusters we find evidence for a significant systematic difference with the hydrostatic masses being higher than the caustic masses by about 30% on average. We discuss possible reasons for this effect.

Presenter status

Conference attendee

Primary author(s) :   MAUGHAN, Ben (University of Bristol);   Mr LOGAN, Crispin (University of Bristol)

Presenter(s) :   MAUGHAN, Ben (University of Bristol)

Session Classification :   Clusters and Cosmology I

Contribution ID : **85**   Type : **Poster**

The X-ray Properties of Optically Selected Galaxy Groups

The overlap between the GAMA optical survey and the XXL X-ray survey creates an exciting opportunity to explore galaxy groups across multiple wavelengths with independent selection criteria. This overlap region contains 234 galaxy groups with five or more members optically detected by GAMA. Using forced X-ray aperture photometry on these groups allows the study of their X-ray properties in the regime of very low signal-to-noise X-ray data. Not only does this sample of galaxy groups extend to lower X-ray luminosities than X-ray selected samples, but also has different sources of selection bias. The X-ray luminosity function (XLF) of the sample was explored to look for evidence for non-gravitational processes such as AGN-feedback at low X-ray luminosities which may modify the form of the XLF. Preliminary results are consistent with the extrapolation of the XLF from X-ray selected samples at higher luminosities. Following from this, the data will be used to infer the form of the scaling relation between X-ray luminosity and mass at lower masses and luminosities than has previously been possible in X-ray selected samples. This approach can be translated to eROSITA data, combined with future all-sky optical surveys to constrain the X-ray properties of galaxy groups and clusters in the limits of high redshift and low mass.

Presenter status

Conference attendee

Primary author(s) :   Mr WOOD, Cai (University of Bristol)

Co-author(s) :   MAUGHAN, Ben (University of Bristol)

Contribution ID : **86**   Type : **Oral Presentation**

Simulating clusters and their AGN with IllustrisTNG

Tuesday, 17 March 2020 10:35 (15)

The IllustrisTNG simulations produce an unprecedented sample of thousands of well-resolved galaxies within halos of total mass above 10^13 solar masses. TNG is a series of gravo-magnetohydrodynamical cosmological volumes which enable us to simultaneously resolve the internal structure of galaxies at ~hundred parsec scales, while also capturing the full diversity of entire galaxy populations. The comprehensive, physical model captures a detailed view of the physical interaction between AGN feedback and the hot gaseous atmospheres of these objects, and the influence of the black holes is imprinted on the thermodynamical properties of the gas within and around clusters. I will showcase what we are learning about the stellar mass assembly and quenching of cluster galaxies, as well as their black hole and AGN populations. I will discuss the emergence of cool core and non-cool core cluster populations, as well as the abundance and distribution of x-ray tracing OVII and OVIII in cluster atmospheres. I will connect the physical operation of the galaxy formation model, primarily through the impact of black hole feedback, to x-ray scaling relations and the x-ray properties of halos, and comment on the ability for simulations like IllustrisTNG to make quantitative predictions for eROSITA observables, as well as the potential for the mission to constrain many key aspects of the theoretical models currently employed in cosmological hydrodynamical simulations.

Presenter status

External contribution

Primary author(s) :   Dr NELSON, Dylan (MPA)

Presenter(s) :   Dr NELSON, Dylan (MPA)

Session Classification :   Clusters and Cosmology I

Contribution ID : **87**   Type : **Oral Presentation**

AGN feedback: lessons learned from X-ray surveys and prospects for eROSITA

Wednesday, 18 March 2020 10:00 (15)

Outflowing winds are now revealed routinely in Active Galactic Nuclei and Quasars across the entire electromagnetic spectrum and are invoked in many co-evolutionary models to link the growth of SMBH and galaxies through feedback phenomena. Both numerical simulations and observations have shown that the nature of AGN outflows is multiphase, and that each gas phase embeds a fundamental piece of information on the driving mechanism and on the effect on the host galaxy.
I will present recent results on the detection of strong winds at different scales through dedicated NIR and ALMA follow-ups of luminous obscured AGN, and the implications for AGN/galaxy co-evolution. I will discuss the unique power of AGN X-ray surveys (coupled with deep optical-NIR surveys) in selecting the most promising targets. I will finally discuss the perspectives for the forthcoming eROSITA survey to advance in our understanding of these important phenomena, based on preliminary results of the PV phase observations in the eFEDS field covered by HSC and VIKING.

Presenter status

eROSITA_DE consortium member

Primary author(s) :   BRUSA, Marcella (DIFA - University of Bologna)

Presenter(s) :   BRUSA, Marcella (DIFA - University of Bologna)

Session Classification :   AGN and their host galaxies

Contribution ID : **88** Type : **Oral Presentation**

The ICM: synergies between radio and X-ray observations of clusters

Tuesday, 17 March 2020 14:20 (30)

In a growing number of galaxy clusters diffuse extended radio sources have been found. The radio emission implies the presence of cosmic rays and magnetic fields in the intracluster medium (ICM) on megaparsec scales. An important question is how the cosmic rays are accelerated that produce these extended synchrotron emitting sources. It is generally believed that shocks and turbulence play an important role in the acceleration of these cosmic rays. In this talk I will provide an overview of the synergies between radio and X-ray observations of clusters to understand the nature of the non-thermal ICM components.

Presenter status

Invited speaker

Primary author(s) : VAN WEEREN, Reinout (Leiden University)

Presenter(s) : VAN WEEREN, Reinout (Leiden University)

Session Classification : Clusters and Cosmology II

Contribution ID : **89**   Type : **Poster**

Young accreting binary populations in the pre-eROSITA era

In this talk, I will discuss our current understanding of the formation efficiency of high-mass X-ray binaries (HMXBs) by focusing on results derived from young accreting binary populations in the Magellanic Clouds. Using data from our *Chandra* X-ray Visionary program, extensive shallow *Chandra* and *XMM-Newton* surveys and the literature for the Small and Large Magellanic Cloud (SMC and LMC), respectively, I will present the formation efficiency of HMXBs based on three different indicators: the number ratio of the HMXBs to the (a) total number of OB stars in the same area, (b) the local star-formation rate, and (c) the stellar mass produced during the specific star-formation burst, all as a function of the age of their parent stellar populations. Each of these indicators serves a different role, but in all cases, we find that the HMXB formation efficiency increases as a function of time (following a burst of star formation) up to ~40-60 Myr, and then gradually decreases. The formation efficiency peaks at ~30-40 Myr with average rates of $\mathrm{N(HMXBs)/SFR} = 339^{+78}_{-83}(\mathrm{M}_\odot/\mathrm{yr})^{-1}$, and $\mathrm{N(HMXB)/M}_\star = 8.74^{+1.0}_{-0.92}\mathrm{M}_\odot^{-1}$, in good agreement with previous estimates of the average formation efficiency in the broad ~20-60 Myr age range. Furthermore, I will compare the formation efficiency of HMXBs in the SMC and the LMC. We have found that the formation efficiency of HMXBs in the LMC is ~17 times lower than that in the SMC, primarily due to the different ages and metallicity of these X-ray binary populations in the two galaxies (Antoniou et al. 2016, 2019). Finally, I will discuss questions raised by both X-ray binary population studies and studies of individual objects of interest, and prospects for yet further progress from future observations performed by *eROSITA*.

Presenter status

late abstract submission allowed by Andrea Merloni

Primary author(s) :   ANTONIOU, Vallia (Texas Tech University and CfA | Harvard & Smithsonian)

Co-author(s) :   Dr ZEZAS, Andreas (University of Crete); Dr DRAKE, Jeremy (CfA | Harvard & Smithsonian); Dr BADENES, Carles (University of Pittsburgh); HABERL, Frank

Presenter(s) : ANTONIOU, Vallia (Texas Tech University and CfA | Harvard & Smithsonian)

Contribution ID : **90**   Type : **Oral Presentation**

ICM physics: how to use clusters for cosmology

Tuesday, 17 March 2020 09:00 (30)

eROSITA mission will soon produce an unprecedented number of galaxy clusters, which in turn should help improve X-ray based cosmological measurements. However, in order to use the eROSITA data for precision cosmology, we must improve our understanding of the physics of X-ray emitting intracluster medium (ICM) and develop techniques to control associated systematic uncertainties in cluster mass estimates. In this work, I will discuss (1) recent advances in our understanding of ICM physics and cluster mass estimation based on hydrodynamical simulations and X-ray and microwave observations and (2) strategies to improve both cluster astrophysics and cosmology using the forthcoming eROSITA data.

Presenter status

Invited speaker

Primary author(s) :   Prof. NAGAI, Daisuke (Yale University)

Presenter(s) :   Prof. NAGAI, Daisuke (Yale University)

Session Classification :   Clusters and Cosmology I

Contribution ID : **91**   Type : **Oral Presentation**

eROSITA AGN simulations and preliminary clustering analysis

Tuesday, 17 March 2020 17:15 (15)

In this talk (could also be a poster) I will present a model of how active galactic nuclei populate the cosmic web (detailed in Comparat et al. 2019).
Then I will show preliminary results on the observed angular clustering of point sources in the eROSITA eFEDs PV observations.

Presenter status

Primary author(s) : COMPARAT, Johan (MPE); MERLONI, Andrea; Dr SALVATO, Mara (MPE); Prof. NANDRA, Kirpal (MPE Garching)

Presenter(s) : COMPARAT, Johan (MPE)

Session Classification : AGN physics, variability, clustering

Contribution ID : **92**   Type : **Poster**

Full Stokes Imaging of the Optical Jet in M87

In this study we present linear and circular polarisation maps in the optical rangeof the core and the jet in M87. The observations were acquired two days before theEvent Horizon Telescope campaign in early April 2017. A high degree (~18%) of linearpolarisation is detected in three knots resolved along the jet from~10′′up to23′′(0.8–1.8 kpc) from the centre, while the nucleus and the inner jet linear polarisation remainsone order of magnitude below (~5%). The position angle of the linear polarisationshifts by~90◦from each of these knots to the adjacent ones, being the core polarisationangle perpendicular to that of the first knot. No circular polarisation signal is detectedeither in the nucleus or along the jet at an rms level of0.5%, for those reasons wediscard the conversion of linear into circular polarisation as a possible explanation forthe low degree of linear polarisation within the inner~10′′(e.g. via Faraday rotation).This suggests that the large difference in the linear polarisation degree between thenucleus and the extended jet is likely related to a disordered magnetic field distributionat the base of the jet or a mix of unresolved jet components in the nuclear region withdifferent linear polarisation angles. Further observations of the circular polarisationin M87 at higher angular resolution would be required to probe this scenario. In thiswork we also develop the full methodology to recover the four Stokes parameters usinga polarimeter with a$\lambda/4$wave-plate.

Presenter status

eROSITA consortium member

Primary author(s) :   Ms FRESCO, Alejandra (MPE); Dr FERNANDEZ ONTIVEROS, Juan Antonio (Instituto de Astrofísica de Canarias (IAC), Istituto di Astrofisica e Planetologia Spaziali (INAF–IAPS),); Dr PRIETO, M. Almudena (Instituto de Astrofísica de Canarias (IAC),); Dr ACOSTA-PULIDO, J.A. (Instituto de Astrofísica de Canarias (IAC))

Presenter(s) :   Dr FERNANDEZ ONTIVEROS, Juan Antonio (Instituto de Astrofísica de Canarias (IAC), Istituto di Astrofisica e Planetologia Spaziali (INAF–IAPS),)

Contribution ID : **93**   Type : **Poster**

eROSITA and ART-XC observations of the rapidly spinning-up pulsar SXP 1323

SXP 1323 is a Be/X-ray binary pulsar discovered in 2005 with a pulse period of 1323 s, making the source one of the longest period pulsar known in the Small Magellanic Cloud. Being very close to the bright supernova remnant 1E 0102-72.3, it is often observed for calibration purposes and a large number of observations are therefore available from several X-ray observatories. A period of 26.2 d was observed in the X-ray wavelengths, that was associated with the orbital period, visible as well in the optical OGLE data. Furthermore, a rapid spinning-up of the source was noted in the period from 2006 to 2016, where the pulse period dropped from 1340 to 1100 s, with a $|\dot{P}/P|$ of $0.0172\,\mathrm{yr}^{-1}$.

We report here the results from the analysis of the recent eROSITA and ART-XC observations of the source performed during the CalPV phase in November 2019. The pulse period, detected with both instruments, is now around 1005 s confirming that the source continues to spin-up at a similar rate. The eROSITA spectral model (an absorbed power-law with a power-law index around 0.5-1) is also consistent with what has been reported in the literature from XMM-Newton data.

Presenter status

Primary author(s) :   Dr CARPANO, Stefania (Max Planck Institute for Extraterrestrial Physics)

Co-author(s) :   Dr HABERL, Frank (Max Planck Institute for Extraterrestrial Physics); Dr MOLKOV, Sergey (Space Research Institute (IKI RAS)); Dr LUTOVINOV, Alexander (Space Research Institute (IKI RAS)); Dr MAITRA, Chandreyee (MPE); Dr PAVLINSKY, Mikhail (Space Research Institute (IKI RAS))

Contribution ID : **94**   Type : **Poster**

Detecting the Cosmic Web with eROSITA

The large scale structure of the Universe is organized in a web-like structure known as the Cosmic Web. Inter-connected structures are organized hierarchically,with knots, filaments, sheets and voids. Although it is difficult to detect X-ray emission from the hot gas within filaments,the sensitivity of eROSITA will allow to perform such detection by the stacking of regions connecting neighboring clusters. In this sense, the first eROSITA all-sky-survey (eRASS1) will provide a large sample of close cluster pairs with exceptional data statistic to search for X-ray emission from cosmic filaments. We will perform an analysis of this sample in order to study physical and chemical properties of the filamentary structures.

Presenter status

eROSITA consortium member

Primary author(s) :   GATUZZ, Efrain (MPE)

Co-author(s) :   BULBUL, Esra (MPE); KÄFER, Florian; ERFANIANFAR, Ghazaleh (MPE); IDER CHITHAM, Jacob (MPE); SANDERS, Jeremy (MPE); COMPARAT, Johan (MPE); RAMOS-CEJA, Miriam E. (MPE, Garching); GHIRARDINI, Vittorio (Max Planck Institute for extraterrestrial physics)

Presenter(s) :   GATUZZ, Efrain (MPE)

Contribution ID : **95**   Type : **Poster**

From Dirty Fireballs to AT2018cow: A Broad Landscape of Engine-Driven Stellar Explosions

In the conventional picture of a core-collapse supernova, the iron core collapses into a neutron star or a black hole, and a shockwave unbinds the star. In rare cases, accretion onto a rapidly rotating black hole acts as an "engine" that launches a jet. If that jet tunnels through the star, breaks out, and is pointed at the Earth, we detect a long-duration gamma-ray burst (GRB). There have been thousands of GRBs discovered, almost always by high-energy satellites such as Fermi or Swift. However, recent discoveries by optical surveys hint at diverse outcomes that are invisible to GRB satellites, such as baryon-loaded jets ("dirty fireballs") or jets choked inside the star. With the Zwicky Transient Facility (ZTF) we are conducting a systematic exploration of the broader landscape of engine-driven explosions, including dirty fireballs, choked jets and off-axis afterglows ("orphan afterglows"). I will show how unexpected arrivals to the landscape (such as AT2018cow) complicate the picture, revealing that some engine-driven explosions take place embedded in dense circumstellar material that was likely ejected in eruptive pre-explosion mass-loss episodes. I will emphasize the synergy between eROSITA and optical surveys like ZTF: a distinguishing feature of both dirty fireballs and AT2018cow-like transients is luminous X-ray emission.

Presenter status

Graduate student at Caltech

Primary author(s) : HO, Anna (Caltech); KULKARNI, Shri (Caltech); PERLEY, Daniel (LJMU); PHIN-NEY, E. Sterl (Caltech); CORSI, Alessandra (TTU)

Contribution ID : **97**   Type : **Poster**

Do stellar-mass and super-massive black holes have similar dietary habits?

Through the years several attempts have been made to connect the phenomenology and physics of mass accretion around stellar-mass and super-massive black holes in a scale-invariant fashion. We here try to improve on this connection for the radiatively-efficient end of accretion modes, testing the disk-corona energetic interplay in soft and soft-intermediate states of the X-ray binary (XRB) GX 339-4 with 458 RXTE-PCA archival observations. The observed scatter in the $\log L_{disk} - \log L_{corona}$ plane of XRBs is very high (~ 0.43 dex) and significantly larger than in representative samples of radiatively-efficient Active Galactic Nuclei (AGN, typically ~ 0.30 dex). This is likely related to the XRBs power-law index distribution being broader (dispersion of ~ 0.16 as opposed to ~ 0.08), even accounting for the measured uncertainties, and shifted to softer slopes (mean value of ~ 2.20 as opposed to ~ 2.07). It is notwithstanding remarkable that once similarly broad Γ and $\dot{m}$ distributions are selected, AGN and XRBs overlap quite nicely in the mass-normalised $\log L_{disk} - \log L_{corona}$ plane with a scatter of $\sim 0.30 - 0.33$ dex. Thus, as far as the disk-corona interplay is concerned, it seems more relevant how similarly diverse the disk-corona systems are rather than how different the typical one is between the two source classes. However, this common scatter is still higher than ≤ 0.20 dex, namely what is claimed to be the real physical scatter in the $\log L_{disk} - \log L_{corona}$ in AGN. We conclude that either the two systems are not entirely analogous and should not be scaled without caution, or they are indeed similar, and thus the physical scatter of the disk-corona emission in AGN is not as low as we think, with insightful implications for both accretion physics and quasars cosmology. This analogy will be further pursued studying the AGN population in the eFEDS field with eROSITA in combination with optical spectroscopy and radio coverage adding a third dimension to reach a more comprehensive view on the disk-corona-jet plane.

Presenter status

eROSITA-DE consortium member

Primary author(s) :   ARCODIA, Riccardo (Max-Planck Institute for Extraterrestrial Physics);   Dr PONTI, Gabriele (INAF);   MERLONI, Andrea;   Prof. NANDRA, Kirpal (MPE Garching)

Contribution ID : **98**   Type : **Oral Presentation**

The transient X-ray sky

Friday, 20 March 2020 09:00 (30)

The eROSITA instrument onboard the SRG satellite provides a unique opportunity for discovering transients in its X-ray All Sky survey data. There are many classes of transients known to emit in X-rays, ranging from flares from active stars to fast blazar variability. By necessity, I will highlight a few such source classes and the open science questions that will benefit tremdously from the eROSITA All Sky Survey and timely follow-up. In particular, I will focus on tidal disruption events and the source class of fast X-ray transients.

Presenter status

Invited speaker

Primary author(s) :   Prof. JONKER, Peter (Radboud University & SRON, Netherlands Institute for Space Research)

Presenter(s) :   Prof. JONKER, Peter (Radboud University & SRON, Netherlands Institute for Space Research)

Session Classification :   Time domain and multi-messenger astronomy

Contribution ID : 99   Type : **Oral Presentation**

Characterization of the X-ray properties of the eFEDS detected Clusters

Tuesday, 17 March 2020 09:50 (15)

Constraints on cosmology from cluster number count strongly depend on the accuracy of cluster masses which are sensitive to the dynamical state of clusters, thus it is of importance to be able to measure accurately the dynamical state of each cluster. eROSITA telescope on board of Spectrum-Roentgen-Gamma (SRG) mission was launched in July 2019. eROSITA's large effective area, good spatial resolution, and a large field of view allow observing large areas of the sky. eROSITA Final Equatorial Survey, the largest contiguous, uniformly sampled X-ray field scan to date was completed in just 4 days during the Performance Verification phase. We found more than 400 extended sources in the 140 square degree eFEDS field. In this talk, we will present the measurements of several morphological parameters: surface brightness concentration, ellipticity, cuspiness, power ratios, and photon asymmetry of eFEDS extended sources. The fractional number of clusters with cool-core/non-cool-cores will allow us to investigate the distribution of the morphological parameters with respect to their mass and dynamical state.

Presenter status

Primary author(s) :   GHIRARDINI, Vittorio (Max Planck Institute for extraterrestrial physics)

Presenter(s) :   GHIRARDINI, Vittorio (Max Planck Institute for extraterrestrial physics)

Session Classification :   Clusters and Cosmology I

Contribution ID : **100**   Type : **Oral Presentation**

High mass X-ray binaries in the Magellanic Clouds as seen by eROSITA during the Commisioning/Calibration phase

Wednesday, 18 March 2020 12:30 (20)

High mass X-ray binaries (HMXBs) offer a unique opportunity to study the physics of accretion in extreme environments and magnetic fields. In these systems, matter is accreted from a massive star onto a compact object which is usually a neutron star. A large number of HMXBs is found in the Magellanic Clouds, especially in the Small Magellanic Cloud (SMC). This is attributed to their ideal environment for hosting young stellar remnants, high formation efficiency for HMXBs, as well as relatively small distances and low foreground absorption conducive for performing detailed studies. This enables us to study HMXBs in the Magellanic Clouds down to a point source X-ray luminosity of a few 10^{33} erg/s. We will present the first results from the few HMXB pulsars in the Magellanic Clouds that were in the field of view during the eROSITA calibration and commissioning phase observations including a new X-ray pulsar. We will discuss their spin evolution and spectral properties in the context of accretion onto highly magnetized neutron stars.

Presenter status

eROSITA consortium member

Primary author(s) :   MAITRA, Chandreyee (MPE);   CARPANO, Stefania (Max Planck Institute for Extraterrestrial Physics);   HABERL, Frank;   SASAKI, Manami (Dr. Karl Remeis Observatory, University of Erlangen-Nurnberg)

Presenter(s) :   MAITRA, Chandreyee (MPE)

Session Classification :   X-ray emission from Galaxies

Contribution ID : **101**   Type : **Poster**

The dark matter halo mass function dependence on the halo's dynamical states

eROSITA will provide a large amount of galaxy
clusters, with the possibility to obtain halo mass functions
with improved precision. A key point in this context is understanding the selection effects in galaxy clusters surveys with a cosmological
purpose. An interesting feature is the dynamical state of the
dark matter halo. Relaxed halos are supposed to host cool
core galaxy clusters, making them easier to detect in the
X-ray. On the contrary, non cool core clusters are hosted
by unrelaxed halos. We investigate the variations of the mass
function as a function of the dynamical state of the constituting halos.

Presenter status

Primary author(s) :   SEPPI, Riccardo (MPE);   COMPARAT, johan (MPE)

Contribution ID : **102**   Type : **Oral Presentation**

The calibration of eROSITA on SRG

Monday, 16 March 2020 10:25 (20)

The power of eROSITA, the core instrument on the Russian-German SRG mission, is high sensitivity at high spectral, spatial, and temporal resolution over a large field of view. This is achieved by combining 7 coaligned fast X-ray optics, each composed of 54 mirror shells, to focus the X-rays onto a total of 1 million pixels, which can all be used as spectrographs. On their way to the CCDs, the photons have to penetrate optical blocking filters, because X-ray CCDs are also sensitive to optical light. All these components need to be calibrated in order to make full scientific use of the unique capabilities of eROSITA. The initial ground calibration was done at the PANTER and PUMA facilities of MPE as well as at BESSY, and was completed by an in-orbit calibration. We report on the extensive and often challenging calibration activities performed on ground and in space.

Presenter status

eROSITA consortium member

Primary author(s) :   Dr DENNERL, Konrad (MPE)

Co-author(s) :   Dr VON KIENLIN, Andreas (MPE); Ms HARTNER, Gisela (MPE); Dr FREYBERG, Michael (MPE); MEIDINGER, Norbert (MPE); FRIEDRICH, Peter (HEG); PREDEHL, Peter (Max-Planck--Institut für Exteraterrestrische Physik); Mr GAIDA, Roland (MPE); BURWITZ, Vadim (MPE); Mr EMBERGER, Valentin (MPE)

Presenter(s) :   Dr DENNERL, Konrad (MPE)

Session Classification :   SRG Instruments and Operations

Contribution ID : **103** Type : **Poster**

X-ray population study of Globular Clusters and dwarf spheroidal galaxies

Globular Clusters (GCs) in the Milky Way and dwarf spheroidal galaxies (dSphs) around the Milky Way are nearby laboratories for the study of stellar populations with different masses, ages, and densities. In general, the stellar population in GCs has a significantly higher number density than that of the dSphs. While in dSphs the main population of binary systems are expected to be of primordial nature, formed at the first stages of galaxy evolution, binary systems in dense GCs might have also formed later in their evolution in dynamical interactions. Observations can help us to understand the effect of dynamical interactions on the evolution of binary systems. We present our recent results of X-ray population studies of dSphs (Draco, Sculptor, Willman 1, Leo I, and the centre of Sagittarius dSph) observed with XMM-Newton and Chandra. We also present the first results of the eROSITA observations of the 47 Tucanae Globular Cluster.

Presenter status

eROSITA consortium member

Primary author(s) : Dr SAEEDI, Sara (Dr. Karl Remeis-Sternwarte, Astronomical Institute of the FAU)

Co-author(s) : Prof. SASAKI, Manami (Dr. Karl Remeis-Sternwarte, Astronomical Institute of the FAU); Dr DUCCI, Lorenzo (Institut für Astronomie und Astrophysik Tübingen)

Contribution ID : **104**   Type : **Poster**

Optical Follow-up of the Abell 3391 - Abell 3395 system

The baryonic mass measured from the early Universe through CMB observations makes up only the ~5% of the Universe. Hydrodynamical simulations suggest that the initial density fluctuations form filament-like structures also known as cosmic webs at later times. Clusters of galaxies are found in the dense knots of these cosmic webs. Detecting these filaments, connecting the clusters of galaxies in the late universe is challenging since the expected densities are extremely low. However, density and therefore the emission is expected to be enhanced in the regions where two clusters are nearby, and such systems are detected rarely. The proximity of the A3391-A3395 galaxy clusters and hosting a galaxy group in between provides a perfect laboratory to study this emission. The previous effort was made using X-Ray telescopes such as XMM-Newton, Chandra, and SUZAKU and also through Sunyaev Zeldovich effect using Planck data. Most robust data recently came from eROSITA not only showing the emission from the bridge between the clusters but also several other extended X-ray emission surrounding the system. In order to draw conclusive results, optical follow-ups on the system are required. I will provide the information on the existing redshifts on the cluster region and the results from currently studied optical data from the Dark Energy Camera (DECam) on the BLANCO telescope. I will also present the measured photometric redshifts and possible optical counterparts of the extended objects detected in X-Ray with eROSITA.

Presenter status

eROSITA consortium member

Primary author(s) :   Mr KARA, Melih (Argelander-Institut für Astronomie)

Co-author(s) :   Dr ERBEN, Thomas (Argelander-Institut für Astronomie); Prof. REIPRICH, Thomas H. (Argelander-Institut für Astronomie); Dr ZENTENO, Alfredo (National Optical Astronomy Observatory · Cerro Tololo)

Contribution ID : **105**   Type : **Poster**

Spectral Analysis of A3391/95 with XMM-Newton

It is known that there is a disagreement between the observed and predicted number of baryons in the Universe. The theory suggests that these missing baryons may be located in the cosmic web filaments, namely, the Warm-Hot Intergalactic Medium (WHIM). The most commonly used objects to probe WHIM are galaxy clusters, since these extremely massive collapsed objects are located in the intersections of the filaments. The most advantageous geometry to detect WHIM is predicted to be the region between two nearby galaxy clusters. One such system is the interacting galaxy cluster system Abell 3391 and Abell 3395 (A3391/95).

The A3391/95 system has previously been observed by several X-ray telescopes, e.g. ROSAT, Chandra, Suzaku, XMM-Newton. Soft emission originating from the region between these two clusters was detected, however, only faintly. This emission was also seen with Planck in the (sub)mm regime. The newly launched X-ray telescope, eROSITA shows over a large area and in great detail the presence of a filament-like structure that bridges these clusters. Further investigation still needs to be done to determine the properties of this structure and the system itself. With this goal in mind, I will present a spectral analysis of the A3391/95 system with XMM-Newton, which will later be cross-calibrated with eROSITA.

Presenter status

eROSITA consortium member

Primary author(s) : VERONICA, Angie (AIfA)

Co-author(s) : Dr PACAUD, Florian (AIfA); Prof. OTA, Naomi (AIfA, Nara Women's University); Prof. REIPRICH, Thomas H. (AIfA); Dr BULBUL, Esra (MPE); ECKERT, Dominique

Contribution ID : **106** Type : **Poster**

A look at the first NuSTAR coverage of eROSITA survey sources

At full depth, the eROSITA all-sky surveys will detect ~50% of NuSTAR survey sources. Here we make an initial characterisation of the first eFEDS sources to be detected at high energies (E>8keV) with NuSTAR.

Presenter status

External collaborator

Primary author(s) : Dr LANSBURY, George (ESO)

Contribution ID : **107**   Type : **Poster**

Ultra Luminous X-ray sources - new distance indicators?

We fit the NuSTAR and XMM-Newton data of three sources: NGC7793 P13, NGC5907 ULX1, and Circinus ULX5. Our single model contains emission form non-spherical system: neutron star plus accretion disk directed towards observer. We obtained the very good fit with the reduced χ^2 per degree of freedom equal 1.08 for P13, 1.01 for ULX1, and 1.14 for ULX5. The normalization of our model constrains the distance to the source. The resulting distances are $D = 3.41^{+0.11}_{-0.10}, 6.55^{+0.69}_{-0.81}$ and $2.60^{+0.05}_{-0.03}$ Mpc, for P13, ULX1 and ULX5 respectively. The distances to P13 and ULX5 are in perfect agreement with previous distance measurements to their host galaxies. Our results confirm that P13, ULX1 and ULX5 may contain central hot neutron star. When the outgoing emission is computed by integration over the emitting surface and successfully fitted to the data, then the resulting model normalization is the direct distance indicator.

Presenter status

Primary author(s) :   Prof. RÓŻAŃSKA, Agata (CAMK PAN)

Contribution ID : **108**   Type : **Oral Presentation**

Multiwavelength properties of eROSITA point-like sources in the eFEDS area

Monday, 16 March 2020 15:35 (20)

I will present, on behalf of eroAGN and eROFollow-up WGs the multiwavelength counterparts to the eROSITA sources in eFEDS, including their classification (AGN/star). The talk will also cover predictions on our capability to identify the correct counterparts as a function of Ancillary data coverage and depth of X-ray survey (eRASS:1-8).

Presenter status

Primary author(s) :   Dr SALVATO, Mara (MPE); EROAGN, EROFOLLOWUP

Presenter(s) :   Dr SALVATO, Mara (MPE)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : **109** Type : **Oral Presentation**

Unexpected eROSITA spectra of Active Galactic Nuclei

Tuesday, 17 March 2020 17:30 (15)

The first large area survey of eROSITA unveiled a small set of Active Galactic Nuclei with unusually steep and flat spectral slopes. In the calibration period and the all-sky survey eROSITA also revisited well-known X-ray sources. We report on an automated detection of spectral changes in the X-ray sky compared to archival observations, based on the XMM-Newton, Chandra and Swift archives. The bona fide differences can be grouped into 1) drastic steepening of the intrinsic corona power law and 2) occultation of the corona by an intervening cloud. We will discuss the underlying physics and how to probe them through follow-up with X-ray and optical telescopes. The large-scale eRASS monitoring for occultation events in particular are a promising tool to constrain the granularity of the nuclear obscurer.

Presenter status

eROSITA consortium member

Primary author(s) : BUCHNER, Johannes (MPE); KRUMPE, Mirko (AIP); WILMS, Joern; Dr LIU, Teng (MPE Garching); BOGENSBERGER, David (Max Planck Institute for Extraterrestrial Physics); AR-CODIA, Riccardo (Max-Planck Institute for Extraterrestrial Physics); MERLONI, Andrea; Prof. NAN-DRA, Kirpal (MPE Garching); BOLLER, Thomas (MPE Garching); Dr SALVATO, Mara (MPE); RAU, Arne (MPE); LAMER, Georg (AIP); GEORGAKAKIS, Antonis (NOA)

Presenter(s) : BUCHNER, Johannes (MPE)

Session Classification : AGN physics, variability, clustering

Contribution ID : **110**   Type : **Oral Presentation**

Scanning the Chameleon - The eta Cha cluster seen by eROSITA

Thursday, 19 March 2020 10:05 (20)

The eta Chamaeleontis cluster is a nearby, moderately dispersed star forming region at an intermediate age of 5-10 Myr. Its members are prime targets to study pre-main sequence evolutionary models, accretion properties, disc dispersal and planet formation and are repeatedly observed by major ground and space based facilities. The cluster has been observed by eROSITA in mid November 2019 in the field scan mode. The observed field is centered on the B8V star eta Cha, has an extent of 5x5 deg and an exposure time of 150 ks, corresponding to an exposure depth of about 5 ks.

We present first results from the eROSITA observation of the eta Cha field, that provides sufficient large area coverage and sensitivity to study its members down to stellar masses in the M dwarf regime. Detected sources are cross-matched with Gaia and other datasets to identify and characterize the various stellar populations. For the X-ray brighter sources we perform a spectral and temporal analysis, detail their coronal properties and compare them to previous X-ray measurements.

Presenter status

eROSITA consortium member

Primary author(s) :   ROBRADE, Jan (Hamburger Sternwarte)

Presenter(s) :   ROBRADE, Jan (Hamburger Sternwarte)

Session Classification :   X-ray view of the Milky Way: Stars

Contribution ID : **111**   Type : **Oral Presentation**

The stellar content of the eROSITA eFEDS field

Thursday, 19 March 2020 09:50 (15)

We have developed a fully Bayesian scheme to statistically
extract the full stellar source content in the eROSITA all-sky survey.
The identification scheme heavily relies on Gaia data, since
all coronal X-ray sources should have a Gaia counterpart with
significant parallax, and assigns to every X-ray source
a probability with which a given X-ray source is stellar. With
our chosen priors the separation between stellar and non-stellar
sources can be performed with quantifiable values for completeness and
reliability. We apply our identification scheme to the eFEDS field, derive the
HR diagram for the stellar eFEDS sources, construct X-ray luminosity
distribution functions and the spatial stratification for the various
stellar types in the Galaxy. The space density of X-ray active giant binary
systems is derived for the first time.

Presenter status

eROSITA consortium member

Primary author(s) :   SCHMITT, Jürgen (Hamburger Sternwarte)

Presenter(s) :   SCHMITT, Jürgen (Hamburger Sternwarte)

Session Classification :   X-ray view of the Milky Way: Stars

Contribution ID : **112**   Type : **Oral Presentation**

eROSITA constraints on the AGN duty cycle

Friday, 20 March 2020 10:45 (15)

During its PV phase eROSITA observed a ~100 deg2 field to the final depth expected after eight all-sky scans. The XMM Atlas survey is covered in this field. Between these data sets, we search for dramatic flux changes in AGN which would indicate AGN ignition/shut-down. I will present a few candidate events. We will extend this work using the data of all individual eight all-sky surveys by eROSITA. The number of expected events and the clean selection of sources allows us to compute the probabilities that such changes happen. This will result in observational constraints on the AGN duty cycle. For selected events we will trigger follow-up observations (e.g., XMM, VLT).

Presenter status

eROSITA consortium member

Primary author(s) : Dr KRUMPE, Mirko (AIP)

Co-author(s) : Dr MERLONI, Andrea; Dr GEORGAKAKIS, Antonis (NOA); Dr RAU, Arne (MPE); Mr BOGENSBERGER, David (MPE); Dr LAMER, Georg (AIP); Prof. WILMS, Joern (Bamberg); Dr BUCH-NER, Johannes (MPE); Prof. NANDRA, Kirpal (MPE); Dr SAVATO, Mara (MPE); Mr ARCODIA, Riccardo (MPE); Dr LIU, Teng (MPE); Dr BOLLER, Thomas (MPE)

Presenter(s) : Dr KRUMPE, Mirko (AIP)

Session Classification : Time domain and multi-messenger astronomy

Contribution ID : **113**   Type : **Oral Presentation**

X-ray emission from ultracool dwarfs

Thursday, 19 March 2020 09:30 (20)

Ultracool dwarfs (UCDs) are objects with spectral type M7 and later, at the age-dependent transition between stellar and brown dwarf regime. In the predominantly neutral photospheres of UCDs the magnetic field and the matter are expected to show poor coupling, and this should be shutting off the magnetic activity. Nevertheless, radio, Halpha and X-ray emission has occasionally been observed from UCDs.

The most peculiar feature in the multi-wavelength characteristics of UCDs is their radio/X-ray dichotomy: (a) X-ray flaring objects tend to be radio-faint and (b) radio-bursting UCDs are mostly undetected in the X-ray band. These two groups have been associated with (a) 'normal' magnetic activity as observed on solar-type stars and (b) phenomena seen on the giant planets of the Solar System, respectively. For UCDs the nature of the corona is thus poorly understood, and they may represent a transition between solar-like and planetary-like magnetic field structure.

I will present several ongoing projects to characterize the multi-wavelength activity of UCDs. These studies include (i) joint XMM-Newton / JVLA observations to examine the dependence of the radio-X-ray relation on other critical parameters such as rotation rate and magnetic field strength, (ii) the serendipitous detection of an X-ray super-flare on an L dwarf, and (iii) a first look into the eFEDS field which comprises a few tens of UCDs and candidate UCDs.

Presenter status

eROSITA_DE member

Primary author(s) :   STELZER, Beate (IAAT)

Presenter(s) :   STELZER, Beate (IAAT)

Session Classification :   X-ray view of the Milky Way: Stars

Contribution ID : **114** Type : **Oral Presentation**

The eROSITA/XMM-Newton PV campaign on PSR B0656+14

Thursday, 19 March 2020 15:15 (20)

We report on preliminary results of simultaneous eROSITA and XMM-Newton observations of the isolated neutron star PSR B0656+14. Data were obtained for almost 100 ks with eROSITA and 70 ks with XMM-Newton under excellent space weather conditions. The target was chosen to investigate a weak absorption feature between 0.5 and 0.6 keV that was tentatively identified in previous deep XMM-Newton observations, to exploit the improved spectral resolution provided by eROSITA. The pulsar is also used to determine the timing accuracy of the eROSITA cameras in reference to the external XMM-Newton signal. Science opportunities offered by this ultra-deep pointed observation some 8 degrees above the galactic plane are also briefly described.

Presenter status

eROSITA consortium member

Primary author(s) : Dr SCHWOPE, Axel (AIP)

Co-author(s) : Dr PIRES, Adriana (PMO); MAITRA, Chandreyee (MPE); Dr HABERL, Frank (MPE); Mr KURPAS, Jan (AIP); Prof. WERNER, Klaus (IAAT); Dr RAMOS-CEJA, Miriam (MPE); Dr SULEIMANOV, Valeri (IAAT); BECKER, Werner (Max-Planck Institut für extraterr. Physik)

Presenter(s) : Dr SCHWOPE, Axel (AIP)

Session Classification : X-ray view of the Milky Way: Compact Objects

Contribution ID : **115**   Type : **Poster**

Analysis of Single Reflections from the eROSITA Wolter Optics

An undesired property of Wolter telescopes with a large field-of-view is that, in addition to the double reflection that leads to the actual image, also single reflections occur on the parabolic and in particular on the hyperbolic part of the mirror. These come from off-axis light sources whose off-axis angle is approximately twice the angle of inclination of the paraboloidal surface w.r.t the optical axis. In a nested mirror system, there is a variety of different inclination angles, so that the angular range of off-axis light sources that generate single reflections is correspondingly large. With eROSITA, this angular range extends approximately from 0.5 to 3 degrees off-axis. About 90% of the single reflections are shielded by the X-ray baffle. The remaining ones contribute to the background. However, bright sources create recognizable arcuate structures in the field-of-view. These structures are analyzed on the basis of selected pointing observations and compared with ray tracing simulations.

Presenter status

Primary author(s) : FRIEDRICH, Peter (Max-Planck-Institut für extraterrestrische Physik); FREY-BERG, Michael (Max-Planck-Institut für extraterrestrische Physik)

Contribution ID : **116** Type : **Poster**

X-ray study of shear selected clusters in the eFEDS field

We present a preliminary comparison of two samples of galaxy clusters detected using different observational techniques. We consider shear-selected galaxy clusters from the HSC survey and X-ray selected galaxy clusters from the eFEDS field, which was observed by eROSITA. The former cluster detection technique is purely gravitational and is insensitive to complicated baryon physics, while the latter cluster detection technique is possible thanks to the free-free and line emission of the intra-cluster medium. Both galaxy cluster samples are selected from the same approximately 40 square degrees sky area. The primary aim is to examine the physical differences between these galaxy cluster samples and their selection functions.

Presenter status

eROSITA consortium member

Primary author(s) : RAMOS CEJA, Miriam Elizabeth (MPE)

Co-author(s) : MIYAZAKI, Satoshi; Dr BULBUL, Esra (MPE); CHIU, I-Non; Dr ECKERT, Dominique; GHIRARDINI, Vittorio (Max Planck Institute for extraterrestrial physics); Dr MITSUISHI, I.; Dr MIYATAKE, H.; Dr NISHIZAWA, A.; OKABE, Nobuhiro (Hiroshima Univ.); Dr OGURI, Masamune; OTA, Naomi (AIfA); PACAUD, Florian (AIfA, University of Bonn); REIPRICH, Thomas H. (AIfA, University of Bonn)

Contribution ID : **117**   Type : **Poster**

Additional clumps, groups and clusters in the A3391/95 eROSITA observation

The eROSITA observation of the interacting A3391/95 galaxy cluster system has revealed an impressive overview of its surroundings. In approximately 14 square degrees of sky area with a nominal exposure of several ks over most of the area in the 0.2—2 keV energy band, we have found more than 50 extended objects. These objects are mainly fore- and background galaxy groups and clusters as well as a non-negligible number of clumps, which are presumably falling onto the main galaxy cluster system. In this work, we present some X-ray properties of the most prominent objects as well as a preliminary estimation of the impact of nearby large-scale structures, like A3391/95, will have on the eRASS cluster selection function.

Presenter status

eROSITA consortium member

Primary author(s) :   RAMOS CEJA, Miriam Elizabeth (MPE)

Co-author(s) :   CLERC, Nicolas (IRAP);   REIPRICH, Thomas H. (AIfA, University of Bonn);   Dr ECKERT, Dominique;   PACAUD, Florian (AIfA, University of Bonn);   Dr BULBUL, Esra (MPE);   KARA, Melih

Contribution ID : **118** Type : **Poster**

Calibration of the ART-XC Mirror Modules

The eight ART-XC mirror module assemblies, including one flight spare, were designed, fabricated and tested at NASA's Marshall Space Flight Center and delivered to the Space Research Institute (IKI) in 2014. The properties of each mirror module as measured on the ground are presented. The majority of these measurements were made at MSFC's Stray Light Facility using an imaging CCD camera at low energies and a (non-flight) CdTe detector at higher energies. Measurements included imaging performance (point spread function characterization) and throughput (energy-dependent on- and off-axis effective area). Comparison to performance verification phase observations show the ART-XC mirrors are performing nominally and that results of ground calibration can be used to predict in-flight performance.

Presenter status

ART-XC consortium member

Primary author(s) : Dr SWARTZ, Douglas (NASA MSFC/USRA); CHEN, Chien-Ting (NASA MSFC/USRA); Dr EHLERT, Steven (NASA MSFC)

Contribution ID : **119**   Type : **Poster**

The X-ray activity-rotation-age relation of M dwarfs

The activity-rotation relation of M dwarfs provides observational evidence of the stellar dynamo, which are poorly understood for low-mass stars especially in the fully convective regime. Effects of rotational evolution are also encoded in the empirical rotation-activity relation, because stellar rotation slows down throughout a star's main-sequence life and, consequently, the dynamo efficiency also decreases over time causing a decrease of X-ray luminosity.

From past studies it is known that the X-ray activity-rotation relation splits into two regimes with different rotational dependence: the saturated regime for faster rotating stars and the unsaturated regime for slower rotating stars, with a transition between the two regimes at a rotation period $P_{rot} \sim 10\,$d.

I present our study of the behaviors in both regimes with new XMM-Newton and Chandra X-ray observations and new rotation periods from the Kepler Two-Wheel (K2) mission.

We have updated data sets from the previous literature. The combined database has allowed us to study the activity-rotation relation of M dwarfs in three different mass ranges.

Our new findings include:

1. a non-constant X-ray luminosity (L_x) in the saturated regime,

2. a mass-dependence of the slope in the unsaturated regime

3. a remarkable gap with a paucity of objects at $L_x/L_{bol} \sim 10^{-4}$, probably associated to a phase of stalled rotational evolution followed by an episode of rapid spin-down,

4. different slopes in the unsaturated regime for different parametrizations of the Rossby number ($R_O = P_{rot}/\tau_{conv}$, where τ_{conv} is the convective turnover time).

Combining our best fit parameters from the $L_x - P_{rot}$ analysis with spin-down models we constructed the first L_x-age relation for M dwarfs and we compared it to the activity of M stars with known age.

Finally I show how we use the eFEDS field of eROSITA combined with new rotation periods from TESS to obtain additional constraints on the activity-rotation relation of M dwarfs, especially in the critical transition between the saturated and the unsaturated regime.

Presenter status

eROSITA consortium member

Primary author(s) :   MAGAUDDA, Enza

Co-author(s) :   STELZER, Beate (IAAT); Dr RAETZ, Stefanie (Institut für Astronomie und Astrophysik, Eberhard-Karls Universität Tübingen, Sand 1, D-72076 Tübingen, Germany); Prof. COVEY, Kevin (Department of Physics & Astronomy, Western Washington University, Bellingham WA 98225-3164, USA); Prof. MATT, Sean (University of Exeter, Department of Physics & Astronomy, Physics Bldg., Stocker Road, Exeter EX4 4QL, UK); Prof. SCHOLZ, Alexander (SUPA, School of Physics & Astronomy, University of St Andrews, North Haugh, St Andrews, KY169SS, UK)

Presenter(s) :   MAGAUDDA, Enza

Contribution ID : **120**   Type : **Poster**

A Redistribution Matrix for ART-XC

Spectral analysis of X-ray sources detected by ART-XC hinges crucially on the accuracy of the redistribution matrix file (RMF), which relates the probability of a photon with a given energy E being observed with a particular energy E' in ART-XC's CdTe detectors. This work will discuss efforts by the MSFC team to determine the RMF of ART-XC's detectors using a combination of laboratory data and ART-XC Performance Verification observations of bright X-ray sources obtained during SRG's journey to L2.

Presenter status

ART-XC consortium member

Primary author(s) : EHLERT, Steven (NASA MSFC); CHEN, Chien-Ting (NASA MSFC/USRA); SWARTZ, Doug (NASA/MSFC)

Presenter(s) :   EHLERT, Steven (NASA MSFC)

Contribution ID : **121**
Type : **Poster**

eROSITA ISM investigation via X-ray shadowing

Since the ROSAT era X-ray shadows cast by opaque molecular cloud onto distant soft X-ray emission are an useful tool to disentangle the 3d-structure along the line-of-sight, when comparing on-cloud and off-cloud spectra.

Here we report on initial X-ray shadowing results obtained from data taken during the eROSITA pointed observation phase, before the start of the all-sky surveys.

We outline the analysis procedure (in particular background handling) and compare our findings with corresponding observations from the ROSAT all-sky survey and from XMM-Newton.

Presenter status

eROSITA consortium member

Primary author(s) : Dr FREYBERG, Michael (MPE); PREDEHL, Peter (Max-Planck-Institut für Exteraterrestrische Physik); SASAKI, Manami (Dr. Karl Remeis Observatory, University of Erlangen-Nurnberg); STRONG, Andy; BECKER, Werner (Max-Planck Institut für extraterr. Physik)

Presenter(s) : Dr FREYBERG, Michael (MPE)

Contribution ID : **122**   Type : **Poster**

Characterizing the Stellar Content of eROSITA

The hundreds of thousands of stars that eROSITA will detect in X-rays need comprehensive characterization to exploit their full scientific potential. This characterization ranges from determining basic properties like mass and evolutionary stage to detailed comparisons with other activity tracers and rotation periods. I will present our characterization efforts based on the stellar content extracted from the PV data. I will show that the eROSITA PV data, representative of the final eRASS8 survey, opens a new parameter space in terms of detecting stars resembling our own Sun, a source population that remained largely unexplored previously. Lastly, I will show highlights from our (near-) simultaneous optical monitoring of eROSITA stars, which allows us to perform detailed comparisons between coronal and chromospheric emission tracers for cool stars.

Presenter status

eROSITA consortium member

Primary author(s) :   SCHNEIDER, Christian

Contribution ID : **123**   Type : **Poster**

The ecliptic poles in the XMM-Newton slew survey: A deeper view from stacked source detection

The XMM-Newton slew survey is performed with the EPIC/pn camera since early 2002 while slewing the telescope between targets. More than 85% of the sky have been observed meanwhile, part of it repeatedly. It is deepest around the ecliptic poles, where sky patches were covered between ten and thirty times. From the individual slew stripes, several thousand sources with fluxes down to about 10^{-12} erg cm^{-2} s^{-2} in the 0.2-12.0 keV band have been detected in these regions. Taking overlapping slews into account, the total exposure time increases from about 11s on-axis in a single slew to up to 3-4min per pixel.

To take advantage of their depth, we perform a combined analysis of the overlapping exposures around the ecliptic poles, aiming at a lower limiting sensitivity. It will deliver a large pool of XMM-Newton detections for comparisons with the eROSITA survey, where sensitivities of $2 \times 10^{-14} - 3 \times 10^{-15}$ erg cm^{-2} s^{-2} in the pole regions are expected in eRASS1, and especially for long-term flux and variability studies.

Presenter status

eROSITA consortium member

Primary author(s) :   TRAULSEN, Iris (Leibniz-Institut für Astrophysik Potsdam (AIP))

Co-author(s) :   SCHWOPE, Axel (Leibniz-Institut für Astrophysik Potsdam (AIP))

Contribution ID : **124**   Type : **Poster**

Soft Response Calibration with PSR B0656+14 Observations

The response of the Chandra X-ray telescope in the soft band was recorded much lower than was initially expected before the launch. This depleted response has been documented to be deteriorating over time ever since and it is assumed to be due to the deposition of materials onto either the detector or the filters. The main science goal of eROSITA (**e**xtended **RO**entgen **S**urvey with an **I**maging **T**elescope **A**rray) is to perform a deep X-ray all sky survey, the first since ROSAT observations in 1990. It is important to understand the response of the telescopes over the large range of energies covered by eROSITA. In this sense, it is important to determine whether or not the telescope modules of eROSITA have been affected in a similar way as the Chandra space telescope. Before the commencement of the first stage of the all sky survey, a number of Performance Verification (PV) and calibration observations were carried out, the purpose of which included understanding and modelling the background, determining the contamination status and testing the camera performances. Using the PV observation of the Pulsar, PSR B0656+14, the event files and subsequent images, spectra and light curves of all cameras were compared to each other. Problems were found in telescope module 1 involving the presence of horizontal stripes on the images and the light curve produced was completely erratic. This indicated a problem with the camera electronics which led to the recommendation that the data from TM1 should not be used in any scientific analysis of this particular observation. Extracting the energy spectra and displaying all telescope modules in one plot, we can compare the response from each camera on eROSITA. The main goal of this work is to determine the presence or absence of contamination on the telescope modules which involves fitting a model to the energy spectra and forming a comparison of the residuals. This allows us to quantify the systematic differences between the instruments.

Presenter status

eROSITA consortium member

Primary author(s) :   WHELAN, Beibhinn

Co-author(s) :   ASCHERSLEBEN, Jann (AIfA, University of Bonn);   ILJENKAREVIC, Jana (AIfA, University of Bonn);   PACAUD, Florian (AIfA, University of Bonn);   RAMOS CEJA, Miriam Elizabeth (MPE);   REIPRICH, Thomas H. (AIfA, University of Bonn);   SCHWOPE, Axel (AIP)

Presenter(s) :   WHELAN, Beibhinn

Contribution ID : **125**   Type : **Oral Presentation**

The relationship between growing SMBHs and their host galaxies

Wednesday, 18 March 2020 09:00 (30)

Determining which conditions within galaxies enhance or reduce central SMBH growth is challenging. AGN variability can wash out underlying correlations between galaxy and AGN properties, while AGN selection biases further complicate the observational picture. I will present recent work that addresses these issues, using deep Chandra X-ray data and stellar mass-selected galaxy samples to determine the full distribution of AGN accretion rates within the galaxy population. We trace how the AGN incidence changes as a function of both stellar mass and star formation rate over the bulk of cosmic time (z~0.1-4). We find that within the star-forming population there is a stellar mass dependence to AGN activity; however, no such dependence is seen within the quiescent population. We show that the incidence of AGN within star-forming galaxies on the main sequence is correlated with their SFR, indicating that AGN activity is primarily related to the amount of cold gas in a galaxy. However, we also see that galaxies below the main sequence have a higher AGN incidence, indicating that a broader range of mechanisms are responsible for the triggering and fueling of AGN across the full galaxy population.

Presenter status

Invited speaker

Primary author(s) : Prof. COIL, Alison (UC San Diego)

Presenter(s) : Prof. COIL, Alison (UC San Diego)

Session Classification : AGN and their host galaxies

Contribution ID : **126**   Type : **Oral Presentation**

Structural properties of the host galaxies of eROSITA AGN with Subaru/HSC

Wednesday, 18 March 2020 09:45 (15)

The growth history of supermassive black holes is known to be influenced by their environment from the host galaxy to larger scale structure. However, the direct physical mechanisms involved are not fully understood. The wide imaging, depth, and superb spatial resolution of the Subaru Hyper-Suprime Cam Strategic Survey Program provides the opportunity to make significant progress. For instance, the imaging is enabling the structural properties of luminous AGN to be measured up to z ~ 1. We will present the size and light profile analysis (i.e., Sersic indices) of the hosts of eROSITA AGNs with a comparison to normal galaxies both star-forming and quiescent at equivalent redshifts and stellar masses. These results establish whether most black hole growth occurs in galaxies also forming stars on specific physical scales (disk vs. bulge). We will also touch upon related eFEDS efforts: (1) the morphological analysis of the full galaxy population in eFEDs for studies of environmental effects using eFEDS clusters as an environmental indicator, and (2) galaxy-galaxy lensing to quantify where within dark matter halos AGNs prefer to reside.

Presenter status

Primary author(s) :   SILVERMAN, John (Kavli IPMU)

Presenter(s) :   SILVERMAN, John (Kavli IPMU)

Session Classification :   AGN and their host galaxies

Contribution ID : **127**   Type : **Oral Presentation**

eFEDS view of WISE 22 μm-selected galaxies/AGNs collaborated with Subaru Hyper Suprime-Cam

Wednesday, 18 March 2020 10:15 (15)

We present physical properties (e.g., X-ray luminosity and hardness ratio) of WISE 22 μm-selected galaxies/AGNs. Using a latest eFEDS X-ray point source catalog with optical and mid-infrared (IR) counterparts, we made a sub-sample of 2102 objects with S/N (22 μm) > 5.0. After removing possible stars, we cross-identified with KiDS, VIKING (near-IR), and H-ATLAS (far-IR) catalogs, which yielded 268 objects at $0 < z < 2.5$ in $\sim$50 deg^2. Photometric redshift of some objects are estimated based on the Hyper Suprime-Cam on the Subaru telescope. We derived their stellar mass, star formation rate (SFR), AGN 6 μm luminosity (L_6^{AGN}), and IR luminosity (L_{IR}) based on spectral energy distribution fitting with CIGALE. We also estimated their 2-10 keV luminosity (L_{X}) and hardness ratio (HR). We found that about 20% of objects are expected to be hyperluminous IR galaxies with $L_{\mathrm{IR}} > 10^{13} \ L_{\odot}$. Their stellar mass-SFR relation would suggest that they have an active star-formation regardless of their redshift. We confirmed a tight correlation between L_6^{AGN} and L_{X}, and about 15% of objects are expected to be moderately obscured population with hydrogen column density (N_{H}) > 10^{23} cm^{-2}, which is roughly consistent with what is inferred from HR.

Presenter status

External collaborator (Subaru Hyper Suprime-Cam)

Primary author(s) :   Dr TOBA, Yoshiki (Kyoto University)

Co-author(s) :   Dr SALVATO, Mara (MPE); Dr BRUSA, Marcella (DIFA - University of Bologna); Prof. AKIYAMA, Masayuki (Tohoku University); Dr GOULDING, Andy (Princeton University); Dr ICHIKAWA, Kohei (Tohoku University); Dr KAWAGUCHI, Toshihiro (Onomichi City University); Prof. KOHNO, Kotaro (The University of Tokyo); Dr MERLONI, Andrea; Prof. NAGAO, Tohru (Ehime University); Dr SUH, Hyewon (NAOJ); Prof. TERASHIMA, Yuichi (Ehime University); Dr UEDA, Yoshihiro (Kyoto University); Dr URRUTIA, Tanya (Leibniz Institut für Astrophysik, Potsdam)

Presenter(s) :   Dr TOBA, Yoshiki (Kyoto University)

Session Classification : AGN and their host galaxies

Contribution ID : **128**   Type : **Oral Presentation**

First results on AGN from eFEDS

Monday, 16 March 2020 14:55 (20)

eFEDS (the eROSITA Final Equatorial Depth Survey) is a CalPV program of the German eROSITA consortium. Using a field-scan observing strategy, eFEDS covers an area of approximately 130 deg^2 in an equatorial field with comprehensive mult-wavelength coverage, notably with Subaaru HSC, VISTA/VIKING and the GAMA spectroscopic survey. With a total exposure time of around 400ks, eFEDS achieves the same nominal depth expected over the whole sky at the end of the 4-year eROSITA all-sky survey. This allows a direct verification and accurate prediction of the expected eRASS X-ray source populations, which are dominated by AGN at high Galactic latitudes such as this. An overview of the first AGN results in eFEDS will be presented.

Presenter status

eROSITA Consortium Member

Primary author(s) :   NANDRA, Kirpal (MPE)

Presenter(s) :   NANDRA, Kirpal (MPE)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : **129**   Type : **Poster**

Fermi Bubbles and Galactic non-thermal emission: prospects for eRosita.

The Fermi Bubbles are extended gamma-ray features discovered by the Fermi-LAT gamma-ray telescope. They are elliptical in shape, about 40 by 50 degrees diameter, and symmetric about the Galactic Centre both vertically and horizonally. Their physical size is several kpc. They are probably associated with AGN or starburst activity at the Galactic Centre, and the emission mechanism is most likely inverse-Compton scattering by relativistic electrons. They have also been detected in radio, studied in X-rays with Suzaku, and are probably related to the Galactic Centre chimney seen in X-rays with XMM. The Bubbles contain hot gas which is expected to emit in X-rays, and non-thermal emission is predicted in hard X-rays too. Their large extent on the sky makes the Bubbles an ideal target for the wide-field survey of eRosita. Current Fermi-LAT data allow a precise template to be derived for eRosita studies. Predictions and sensitivity estimates for eRosita will be presented.

In addition, the Galactic interstellar medium emits non-thermally down to X-rays, competing with the source populations and thermal emission which dominate at low energies. Predictions based on the GALPROP model of cosmic-rays and non-thermal processes will be presented.

Presenter status

eROSITA consortium member

Primary author(s) : STRONG, Andy; HABERL, Frank; Dr FREYBERG, Michael (MPE); SASAKI, Manami (Dr. Karl Remeis Observatory, University of Erlangen-Nurnberg)

Presenter(s) : STRONG, Andy

Contribution ID : **130**   Type : **Poster**

eROSITA/XMM-Newton/Suzaku Cluster Temperature Cross-Calibration with the UGC03957 Galaxy Cluster

eROSITA will provide new data to further investigate Dark Energy and therefore the accelerated expansion of our Universe. The eROSITA telescope will observe about 50-100 thousand galaxy clusters within its journey. The X-ray emission of the hot intergalactic medium of these clusters provides information about the temperature and facilitates the study of their large scale distribution.

In order to be able to make a qualified data analysis the calibration of the eROSITA telescope needs to be validated first. One route to this is the cross-calibration with other X-ray telescopes using non-variable sources like galaxy clusters. For this purpose the low temperature galaxy cluster UGC03957 was observed in the initial phase of data recording. In this project the temperature profile of the UGC03957 galaxy cluster is extracted from the eROSITA data. Therefore, the data is cleaned by removing e.g. particle flare contaminated events and masking the X-ray point sources in the extraction area. The area around the cluster center is divided into several annuli and a model is fitted to the corresponding energy spectrum of each annulus. The obtained temperature profile is compared to the results of the XMM-Newton and Suzaku data. First analysis results indicate good agreement amongst the telescopes.

Presenter status

eROSITA consortium member

Primary author(s) : ASCHERSLEBEN, Jann

Co-author(s) : REIPRICH, Thomas H. (AIfA, University of Bonn); PACAUD, Florian (AIfA, University of Bonn); WHELAN, Beibhinn; VERONICA, Angie (AIfA); ILJENKAREVIC, Jana (AIfA, University of Bonn); Dr BULBUL, Esra (MPE)

Presenter(s) : ASCHERSLEBEN, Jann

Contribution ID : **131**   Type : **Oral Presentation**

Timing capabilities of the ART-XC telescope and precision of the on-board clock

Monday, 16 March 2020 12:30 (15)

We demonstrate here the timing capabilities of the ART-XC telescope
on the time scale from several milliseconds to few seconds. The work was done
based on the data of observations of several pulsars emitting in X-rays. The
observations were carried out during the in-flight Calibration and
the performance verification (PV) phases. Using these data we tested
the stability of the on-board clock and found that the clock is slowing down
with rate approximately 10 ms per day. This lag have been confirmed
also by measurements from the on-ground receiving stations.

Presenter status

ART-XC consortium member

Primary author(s) :   Dr MOLKOV, Sergey (Space Research Institute, Moscow);   SRG/ART-XC TEAM

Presenter(s) :   Dr MOLKOV, Sergey (Space Research Institute, Moscow)

Session Classification :   SRG Instruments and Operations

Contribution ID : **132**   Type : **Poster**

XUV response and filter integrity - results from commissioning and CalPV phase

Soft X-ray sources such as White Dwarfs are quite bright at XUV energies and therefore can be used to determine the XUV response of the cameras and to check the filter integrity.

During commissioning phase the White Dwarf PG 1658+441 (EUVE J1659+44.0, 30000K) was observed with TM6 on-axis in three different filter wheel positions ("open", "closed", "filter"). The respective offsetmaps and noisemaps were analysed. The White Dwarf was detected only in the noise map with filter wheel in position "open". However, it could not be detected in any offset map.

During CalPV phase the White dwarfs RE J2334-471 (57000K) and GD 394 (EUVE J2112+50.0, 39000K) were observed on-axis and off-axis. Offset maps with filter wheel in position "open", "closed" and "filter" were taken. In none of the offset maps a significant detection of the White Dwarfs was possible.

Presenter status

eROSITA consortium

Primary author(s) :   FRIEDRICH, Susanne (MPE); Dr FREYBERG, Michael J. (MPE)

Contribution ID : **133**   Type : **Oral Presentation**

eROSITA spectral analysis of the A3391/95 filament region

Tuesday, 17 March 2020 15:10 (15)

Abell 3391/3395 is a pair of galaxy clusters at z=0.05. The clusters A3391, A3395, and a galaxy group located between the two clusters are in alignment along a large-scale filament. The previous studies by ASCA, ROSAT, Planck, Suzaku, and Chandra indicate and confirm that A3395 and A3391 are connected by the filament with hot diffuse gas. The eROSITA first-light observation of A3391/95 has been conducted, whose deepest X-ray data enable us to constrain the properties of warm (~2e6 K) and hot gas components in the filament. In this presentation, we report early results of spectral and image analyses of the filament region.

Presenter status

eROSITA consortium member

Primary author(s) :   OTA, Naomi (AIfA)

Co-author(s) :   REIPRICH, Thomas H. (AIfA, University of Bonn); PACAUD, Florian (AIfA, University of Bonn); VERONICA, Angie (AIfA); KARA, Melih; RAMOS CEJA, Miriam Elizabeth (MPE); Dr ECKERT, Dominique; Dr BULBUL, Esra (MPE)

Presenter(s) :   OTA, Naomi (AIfA)

Session Classification :   Clusters and Cosmology II

Contribution ID : **134**   Type : **Poster**

X-ray study of optically-selected clusters in the eFEDS field

The Subaru HSC survey is capable of detecting a large number of distant clusters, and a catalog of optically-selected clusters at 0.1 < z < 1.4 has been constructed. In the X-ray regime, the eROSITA survey will significantly improve both sample size and uniformity. Thus, a combination of two surveys enables us to systematically study the scaling relations and their dependence on cluster dynamical status over wide redshift and mass ranges. We search for X-ray counterparts of ~1200 optical clusters in the eFEDS field. We carry out the image and spectral analyses of high-richness clusters to determine the X-ray - BCG offset, gas temperature, and X-ray luminosity. In this paper, we present the first result of this project and plans.

Presenter status

eROSITA consortium member

Primary author(s) :   OTA, Naomi (AIfA)

Co-author(s) :   MITSUISHI, Ikuyuki (Nagoya University); BRÜGGEN, Marcus (University of Hamburg); Dr BULBUL, Esra (MPE); CHIU, I-Non; ERFANIANFAR, Ghazaleh (MPE); GHIRARDINI, Vittorio (Max Planck Institute for extraterrestrial physics); GRANDIS, Sebastian; HOANG, Duy; HUANG, Song; KLEIN, Matthias; LIN, Yen-Ting; MIYATAKE, Hironao; Dr OGURI, Masamune; OKABE, Nobuhiro (Hiroshima Univ.); POON, Helen; RAMOS-CEJA, Miriam E. (MPE, Garching); REIPRICH, Thomas H. (AIfA, University of Bonn); SANDERS, Jeremy (MPE)

Contribution ID : **135**   Type : **Oral Presentation**

Large scale view of the Abell 3391/95 multiple galaxy cluster system

Tuesday, 17 March 2020 14:50 (20)

We present the large-scale multi-wavelength view of the nearby (z~0.05) Abell 3391/95 multiple galaxy cluster system. We have obtained (i) the first deep (~10 ks nominal) large-area (~10 sq.deg) high-quality X-ray data using eROSITA in scan mode during its Performance Verification Phase; (ii) an even larger scale sensitive (~30 uJ) radio continuum image obtained with ASKAP as part of the EMU Early Science observations; (iii) dedicated DES-depth DECam pointed observations covering the full eROSITA scan region. The eROSITA data reveal in detail the gas bridge connecting the A3391 cluster and the A3395n/s double cluster as well as a number of infalling matter clumps surrounding the entire system, and, of course, many background AGN, galaxy groups, and clusters. Relativistic plasma from a variety of sources is detected in the ASKAP image, including wide angle tail galaxies tracing relative motions to the hot gas in the system, and possible radio relics. Those structures are traced by the galaxy distribution as characterized in the deep multicolor DECam images. Here, we provide an overview of the data and first science results.

Presenter status

eROSITA consortium member

Primary author(s) :   Prof. REIPRICH, Thomas (Argelander-Institut für Astronomie, Universität Bonn)

Co-author(s) :   ET AL.

Presenter(s) :   Prof. REIPRICH, Thomas (Argelander-Institut für Astronomie, Universität Bonn)

Session Classification :   Clusters and Cosmology II

Contribution ID : **136** Type : **Oral Presentation**

Tidal Disruption Events in the eROSITA Era

Friday, 20 March 2020 10:15 (15)

Due to eROSITA's cadence and its 30-fold increased sensitivity in the soft X-ray band relative to ROSAT, eROSITA promises to detect 1000s of tidal disruption event (TDE) candidates during its all sky survey phase. I will present our machine-learning assisted approach for identifying TDE candidates amongst the millions of X-ray sources in eROSITA's source catalogues, and selected early results from the first months of the all-sky survey.

Presenter status

eROSITA consortium member

Primary author(s) : MALYALI, Adam (MPE); Dr RAU, Arne (MPE Garching); Prof. NANDRA, Kirpal (MPE Garching); MERLONI, Andrea; SCHWOPE, Axel (AIP)

Presenter(s) : MALYALI, Adam (MPE)

Session Classification : Time domain and multi-messenger astronomy

Contribution ID : **137**   Type : **Oral Presentation**

The eROSITA view of the merging cluster Abell 3266

Tuesday, 17 March 2020 12:50 (20)

Abell 3266 is a fascinating merging galaxy cluster system, showing a great deal of substructure. There is a plume of low entropy gas running from the core of the cluster, which may be material stripped from a subcluster (Sauvageot et al. 2005; Finoguenov et al. 2005). eROSITA observed A3266 as a calibration target. The wide field of eROSITA and uniform coverage provide an excellent opportunity to study the cluster in detail and understand the merging process. We examine the temperature, metallicity and surface brightness distributions in the core of this cluster. By comparison with simulations, and using mutliwavelength datasets, we discuss the most likely scenarios which took place to form the cluster seen today.

Presenter status

eROSITA consortium member

Primary author(s) :   SANDERS, Jeremy (MPE);   Dr BULBUL, Esra (MPE);   REIPRICH, Thomas H. (AIfA, University of Bonn);   PACAUD, Florian (AIfA, University of Bonn);   Dr FREYBERG, Michael J. (MPE);   Dr ECKERT, Dominique;   Dr DENNERL, Konrad (MPE)

Presenter(s) :   SANDERS, Jeremy (MPE)

Session Classification :   Clusters and Cosmology I

Contribution ID : **138**   Type : **Oral Presentation**

X-ray imaging of the supernova remnants with Spectrum-RG

Thursday, 19 March 2020 12:15 (20)

Supernova remnants are prominent candidates for the acceleration of the Galactic cosmic rays. SNRs are well-known sources of thermal X-ray emission originated from the shock-heated gas and non-thermal (synchrotron) emission caused by very high-energy electrons moving in the magnetic fields. Non-thermal X-ray synchrotron emission provides important information about particle acceleration properties, magnetic field strengths and turbulence near SNR shock fronts. From the observational point of view, SNRs are difficult objects to study in X-ray band due to their large extent on the sky. Thanks to the optimized for X-ray surveys optical design of eRosita and ART-XC telescopes onboard SRG observatory, the X-ray imaging of the extended objects like SNRs is greatly improved in soft (0.3-10 keV, eRosita) and hard (4-30 keV, ART-XC) X-ray bands. First ART-XC performance verification (PV) observation of bright SNR RX J1713.7−3946 and regular slew across SNR Cassiopeia A during the on-going survey, revealed an impressive potential of SRG for studying SNRs. In this talk I will demonstrate imaging capabilities of the ART-XC for extended objects and present first results of observations of the SNRs with ART-XC telescope.

Presenter status

ART-XC consortium member

Primary author(s) :   KRIVONOS, Roman (Space Research Institute (IKI));   SRG/ART-XC TEAM

Presenter(s) :   KRIVONOS, Roman (Space Research Institute (IKI))

Session Classification :   X-ray view of the Milky Way: SNe and the ISM

Contribution ID : **139** Type : **Poster**

Searching for high-redshift AGN with eROSITA

The identification of super-massive black holes at high redshifts (z>5) raises the question of their physical origin and constrains the accretion history in the early universe. Most of luminous QSOs at these redshifts have been found using optical/NIR drop-out selection methods, with relatively few having been followed-up with X-ray telescopes so far. Direct X-ray searches have not yet significantly improved on the number counts. The eROSITA all-sky survey will allow us to probe the X-ray bright end of the high-redshift AGN population. As a pilot project, we have searched for high-redshift objects in the Legacy DR8 counterparts to eROSITA point-like sources in the eFEDS CalPV survey. We report here the blind X-ray detection of SDSS J083643.86+005453.2, a well known QSO, spectroscopically confirmed at redshift z=5.81. The significance of this detection will be discussed in light of predictions derived from extrapolations of the X-ray luminosity function and the eROSITA sensitivity in this field. The work presented here offers a first glimpse of the high-redshift universe as seen by eROSITA.

Presenter status

eROSITA consortium member

Primary author(s) : WOLF, Julien (Max Planck Institute for Extraterrestrial Physics); Dr SALVATO, Mara (MPE); Prof. NANDRA, Kirpal (MPE Garching); MERLONI, Andrea (MPE)

Session Classification : AGN Surveys and the history of accretion

Contribution ID : **141**   Type : **Poster**

Supernova Remnant Candidates and their prospects for eROSITA

Identified radio supernova remnants (SNRs) in the Galaxy comprise an incomplete sample of the SNR population due to various selection effects. ROSAT performed the first All-Sky Survey (RASS) with an imaging X-ray telescope and thus provided another window for finding SNRs and compact objects that may reside within them. Meanwhile, 14 new SNRs were identified in multi-wavelength identification campaigns based on this RASS data (cf. Prinz & Becker 2012 for a summary). The current list of RASS SNR candidates still includes 72 sources. All have a diameter of > 5', are at a low Galactic latitude (|b| < 15 deg) and have a signal-to-noise ratio greater than 4⊠. Of these candidates, 44 have an diameter of less than 30′, 9 between 30′ - 60′, 4 between 60′ - 120′, and 15 have a diameter larger than 120′. Additional ~300 SNR candidates are listed in the Green catalog of galactic radio SNRs.

The eight eROSITA all-sky surveys, of which the first one started mid December 2019, will provide a sensitivity for diffuse sources located in the galactic plane of about an order of magnitude higher than what was available in the ROSAT All-Sky Survey. It supports to continue the previous SNR identification campaign and to search for new supernova remnants and compact remnants residing in them with un unprecedented sensitivity.

Presenter status

eROSITA consortium member

Primary author(s) :   BECKER, Werner (Max-Planck Institut für extraterr. Physik)

Co-author(s) :   Mr MAYER, Martin (Max-Planck Institut für extraterr. Physik)

Contribution ID : **142** Type : **Poster**

AGN Variability in the SEP

Throughout the all sky surveys, eROSITA scans through the Ecliptic Poles during every rotation, and observes regions close to the poles much more frequently than most other regions of the sky. Not only does this ensure long exposure times of AGN in these regions, but it also enables a detailed study of their variability over a frequently and evenly sampled long stretch of time, allowing for a thorough analysis of changes on short, intermediate, and long time scales.

We will present some initial findings of our study of the properties of the AGN located near the South Ecliptic Pole, based on data from the currently running eRASS1. We will showcase an outlook of what this analysis is likely to yield when run over all 8 eRASS.

Presenter status

eROSITA consortium member

Primary author(s) : Mr BOGENSBERGER, David (Max Planck Institute for Extraterrestrial Physics)

Co-author(s) : Prof. NANDRA, Kirpal (MPE Garching); Dr RAU, Arne (MPE Garching); KRUMPE, Mirko (AIP); Dr LIU, Teng (MPE Garching)

Contribution ID : **143**   Type : **Poster**

Search for Counterparts of unidentified Fermi Sources using eROSITA

The current list of FERMI sources (FL8Y) includes more than 5500 sources above a significance of 4-sigma, with source location regions and spectral properties. More than 2900 of the identified or associated sources are active galaxies of the blazar class, about 220 are pulsars. For about 2100 sources no plausible counterparts at other wavelengths have been found so far. The eROSITA survey presents all-sky X-ray data with an unprecedented sensitivity and thus a unique chance to correlate the FERMI gamma-ray source catalog in order to find counterparts of unidentified Fermi sources. A significant fraction of the unidentified FERMI sources are considered to be rotation-powered pulsars. Those are seen to emit X-ray emission on the ~10^-3 x spin-down energy level. Also many AGNs are X-ray bright. It is therefore a promising task to search for X-ray counterparts of unidentified FERMI sources in the eROSITA all-sky survey data. Follow-up radio and optical observations are planed to support the identification studies.

Presenter status

eROSITA consortium member

Primary author(s) :   BECKER, Werner (Max-Planck Institut für extraterr. Physik)

Co-author(s) :   KRAMER, Michael (Max-Planck-Institut fuer Radioastronomie); SCHWOPE, Axel (AIP); MAYER, Martin (Max-Planck-Institute for Extraterrestrial Physics); HABERL, Frank

Contribution ID : **144**   Type : **Oral Presentation**

The ART-XC Galactic Bulge Survey

Thursday, 19 March 2020 16:55 (20)

In August-September 2019, the ART-XC telescope scanned a large field (about 40 sq. deg) around the Galactic Center for nearly 3 weeks as part of the SRG Cal-PV phase. This resulted in a unique survey of the Galactic Bulge in the hard X-ray band of 4-30 keV. The main results of this survey will be presented, with a focus on the statistical properties of cataclysmic variables and low-luminosity X-ray binaries.

Presenter status

ART-XC consortium member

Primary author(s) :   Prof. SAZONOV, Sergey (Space Research Institute, Moscow); SRG/ART-XC TEAM

Presenter(s) :   Prof. SAZONOV, Sergey (Space Research Institute, Moscow)

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **145** Type : **Poster**

The First, Bright Transient Detected in the eROSITA All-Sky Survey

The eROSITA All-Sky Survey is a treasure trove for exploring the transient and variable X-ray Sky. Utiling the Near-Real Time Transient Analysis (NRTA) software system, we discovered the first bright transient on December 31st 2019. The event, SRGt J123822.3-253206, was discovered in two consecutive scans over the position during which it faded a rapidly. Here, we present the results from the eROSITA data analysis, supported by follow-up optical/near-IR observations with GROND at the MPG 2.2m telescope, and describe possible origination scenarios for the event.

Presenter status

eROSITA_DE consortium member

Primary author(s) : RAU, Arne (MPE)

Co-author(s) : WILMS, Joern; MALYALI, Adam (MPE); WEBER, Philipp (ECAP/FAU)

Presenter(s) : RAU, Arne (MPE)

Contribution ID : **146**   Type : **Oral Presentation**

Source detection and catalogue construction in SRG/ART-XC sky survey

Monday, 16 March 2020 12:10 (20)

The overview of SRG/ART-XC data reduction procedures and source detection algorithms will be presented. Efficiency of various source detection methods will be compared using the results of realistic SRG/ART-XC all sky survey simulations. The construction and properties of X-ray source catalogue, obtained from the first months of SRG/ART-XC all sky X-ray survey started on Dec 8, 2019 will be discussed.

Presenter status

ART-XC consortium member

Primary author(s) :   BURENIN, Rodion (IKI); SRG/ART-XC TEAM

Presenter(s) :   BURENIN, Rodion (IKI)

Session Classification :   SRG Instruments and Operations

Contribution ID : **147**   Type : **Poster**

Spectral analysis of the joint eROSITA and XMM-Newton observation of the NLS1 galaxy 1H0707-495

The well studied Narrow-Line Seyfert 1 galaxy 1H0707-495 has been observed by eROSITA for the first time in October 2019 simultaneously with XMM-Newton. Besides its strong variability, it is most famous for its steep spectral drop at 7 keV. Complementary to the contribution by T. Boller et al., we will present a detailed spectral analysis of this joint observation of 1H0707-495 in this historical low hard flux state. Employing up-to-date relativistic reflection models together with ionized absorption models we will be able to compare our results with previous observations and their interpretation to draw conclusions about the puzzling nature of 1H0707-495.

Presenter status

eROSITA consortium member

Primary author(s) : WEBER, Philipp (EACP/FAU); Dr DAUSER, Thomas (FAU Nürnberg); BOLLER, Thomas (MPE Garching); Prof. NANDRA, Kirpal (MPE Garching); Dr LIU, Teng (MPE Garching); WILMS, Joern (Remeis-Sternwarte & ECAP, FAU Erlangen-Nuernberg)

Contribution ID : **148**   Type : **Poster**

SRG/ART-XC: a first look at high mass X-ray binary pulsars

We analysed the SRG/ART-XC calibration phase pointing observations data, spanning from September to October 2019, to investigate the spectral and timing properties of several high-mass binary X-ray pulsars (2RXP J130159, 4U 1538-522, OAO 1657-415, Cen X-3) in the hard X-ray energy band 4-30 keV. For each of the pulsar an energy spectrum was obtained and approximated using power-law with an exponential cuttoff and comptonization models. A pulse phase resolved spectroscopy has been carried out as well. Timing analysis includes a search for the pulsation and an energy-resolved pulse profile analysis, as well as the search for possible incoherent signals based on the power density spectra in different energy range. Along with the detailed analysis of the given pulsars the SRG/ART-XC performance in a pointing mode was evaluated.

Presenter status

ART-XC consortium member

Primary author(s) :   Mr SHTYKOVSKY, Andrey (IKI); SRG/ART-XC TEAM (IKI)

Presenter(s) :   Mr SHTYKOVSKY, Andrey (IKI)

Contribution ID : **149**   Type : **Oral Presentation**

The SRG/ART-XC survey of the Galactic Plane fields in the direction to the Norma arm and l=+20

Thursday, 19 March 2020 17:15 (15)

We present results of the survey of two regions of the Galactic Plane (Norma
arm and the region around galactic longitude l=+20 deg), obtained with the ART-XC telescope
on board the SRG observatory in hard X-rays during the Cal-PV phase. The
total area covered by this survey was about 50 sq.degrees with the median
exposures of ~700 s in the l+20 field and ~1.4 ks in the Norma arm field, respectively,
that led to the detection of several dozens sources of a different nature.
The properties of this sample as well as individual properties of several bright
sources are discussed.

Presenter status

ART-XC consortium member

Primary author(s) :   Dr SEMENA, Andrey (IKI RAS); SRG/ART-XC TEAM (IKI RAS)

Presenter(s) :   Dr SEMENA, Andrey (IKI RAS)

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **150**   Type : **Oral Presentation**

Study of transient sources with SRG/ART-XC

Thursday, 19 March 2020 15:50 (15)

During first months of the SRG operation the ART-XC telescope (working energy range 4-30 keV) performed observations in different modes: scanning observations of a number of sky fields, pointing observations and all-sky survey. These observations allowed us to discover new transient sources with different observational properties. In particular, the typical time variability of new sources is spanned from dozens seconds or several hours (e.g., for SRGt J123822.3-253206) up to several days (e.g., for SRGa J174956-34086). Spectral characteristics of new sources are also significantly different, that point out to their different nature. In addition to new sources a number of known transient ones in our and nearby galaxies were studied as well. In this presentation we report above mentioned results as well as briefly present the system for the quick look analysis of the ART-XC data.

Presenter status

ART-XC consortium member

Primary author(s) :   LUTOVINOV, Alexander (Space Research Institute (IKI)); SRG/ART-XC TEAM

Presenter(s) :   LUTOVINOV, Alexander (Space Research Institute (IKI))

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **151**   Type : **Oral Presentation**

Background Measurements by the ART-XC X-ray Detectors near L2 point

Monday, 16 March 2020 13:00 (15)

The Astronomical Roentgen Telescope – X-ray Concentrator (ART-XC) is one of two X-ray telescopes onboard the SRG mission launched on July 13, 2019 from Baikonur. ART-XC consists of seven co-aligned mirror modules coupled with seven focal plane CdTe double-sided strip detectors. The ART-XC detectors operate in the energy range from 4 keV to over than 100 keV, while the effective area of the ART-XC mirror modules is negligible at energies above 30 keV. In this energy range the ART-XC detectors background is completely determined by the charged particles. We present the results of measurements of the ART-XC detector background near the Sun-Earth L2 point. The detector background was highly stable in the energy range of 40–100 keV during the first few months of SRG operation at the L2 and the background variations did not exceed ±2%. These are the first background measurements by an X-ray detector near L2 point.

Presenter status

ART-XC consortium member

Primary author(s) : Dr TKACHENKO, Alexey (Space Research Institute, Moscow); SRG/ART-XC TEAM

Presenter(s) : Dr TKACHENKO, Alexey (Space Research Institute, Moscow)

Session Classification : SRG Instruments and Operations

Contribution ID : **152**   Type : **Poster**

Gravitationally lensed QSOs in the eFEDS survey

Gravitationally lensed QSOs are rare objects, only a few hundred objects have been discovered so far. There is growing interest in lensed QSOs due to recent precision measurement of H_0 using the time delay distance.
We have started a project to identify multiple QSO images using the eFEDS X-ray catalogue as a preselected sample of AGN. X-ray selection provides a well defined input sample independent of optical colours which may be affected by blending of the lensing and lensed objects.
The lensed QSOs are identified by using astrometric information from GAIA and photometry from the WISE, SDSS, Subaru HSC, and DECaLS surveys.

We will present the first candidates identified by our survey.

Presenter status

eROSITA consortium member

Primary author(s) :   Dr LAMER, Georg (Leibniz Institut für Astrophysik)

Co-author(s) :   Prof. OGURI, Masamune (University of Tokyo); Dr MORE , Anupreeta (IUCAA, Pune, India); Dr RUSU, Cristian Eduard (NAOJ); Dr SCHWOPE, Axel (Leibniz Institut für Astrophysik); Dr LIU, Teng (MPE); Dr KRUMPE, Mirko (Leibniz Instutut für Astrophysik)

Contribution ID : **153**   Type : **Oral Presentation**

In-flight calibration of the SRG/ART-XC telescope

Monday, 16 March 2020 10:45 (15)

We present results of extensive calibration program performed with ART-XC telescope during the first months of SRG operation. Performance of the ART-XC detectors was calibrated with use of onboard radioactive source while effective area and
point spread function were verified during observations of bright X-ray sources. The derived detector energy resolution of 9% at 14 keV is in good agreement with ground-based measurements.

Presenter status

ART-XC consortium member

Primary author(s) :   MEREMINSKIY, Ilya (Space Research Institute RAS);   SRG/ART-XC TEAM (IKI RAS)

Presenter(s) :   MEREMINSKIY, Ilya (Space Research Institute RAS)

Session Classification :   SRG Instruments and Operations

Contribution ID : **154**   Type : **Poster**

The eROSITA in-flight calibration programme

We summarize the eROSITA in-flight calibration plan, from its design
phase to versions with selected celestial targets
optimized for various launch dates, to planning , implentation and
execution, and finally to the data analysis and the anticipated
calibration parameters.

Presenter status

eROSITA consortium member

Primary author(s) :   Dr FREYBERG, Michael (MPE)

Co-author(s) :   Dr DENNERL, Konrad (MPE)

Presenter(s) :   Dr FREYBERG, Michael (MPE)

Contribution ID : **155**   Type : **Oral Presentation**

The eROSITA camera background at L2

Monday, 16 March 2020 12:45 (15)

We summarize the properties of the eROSITA camera background at L2,
as a function of camera, time, energy, position on detector,
position in orbit, etc.

Presenter status

eROSITA consortium member

Primary author(s) :   Dr FREYBERG, Michael (MPE)

Presenter(s) :   Dr FREYBERG, Michael (MPE)

Session Classification :   SRG Instruments and Operations

Contribution ID : **156**   Type : **Poster**

Finding young, dust reddened quasars with eRosita

Extremely red objects have presented us some of the most interesting objects in the Universe, from ULIRGs at the peak of the star formation history, to some of the highest redshift sources, to Brown Dwarfs in the Milky Way. When coupled with ancillary surveys, such as radio, the incidence of AGN has been shown to be more than 50% also revealing some of the most luminous, but dust obscured objects known. We plan to study the incidence of X-ray AGN among these Extremely Red Objects (EROs) with eRosita. As a secondary step, we will also stack on the positions of these EROs to reveal possible obscured X-ray flux. I will present first results finding these objects in the eFEDS fields and will give an outlook for eRASS1-8.

Presenter status

eROSITA consortium member

Primary author(s) :   URRUTIA, Tanya (Leibniz Institut für Astrophysik, Potsdam); BRUSA, Marcella (DIFA - University of Bologna); TOBA, Yoshiki (Kyoto University); Dr SALVATO, Mara (MPE); MERLONI, Andrea (MPE); Prof. AKIYAMA, Masayuki (Tohoku University); Dr UEDA, Yoshihiro (Kyoto University)

Contribution ID : **157**   Type : **Oral Presentation**

The eROSITA Near Real Time Analysis

Monday, 16 March 2020 11:30 (20)

During each ground station contact of Spectrum X-Gamma, about once every 24h, eROSITA data are telemetered to ground and then immediately subjected to a quick scientific and engineering analysis - the Near Real Time Analysis. The purpose of the scientific analysis done by the NRTA is to identify new transient or strongly variable sources which were detected with eROSITA and to monitor sources that are bright enough that they can be observed in a single pass of the instruments. The NRTA creates automated alerts based on a large set of possible source properties, which are then vetted by the NRTA shift team, which then triggers further observations with other facilities and/or publishes the source information.

This presentation gives an overview of the NRTA setup and operations, discusses what phenomena can be uncovered with it, and gives example results from the first months of NRTA operations.

Presenter status

eROSITA consortium member

Primary author(s) :   WILMS, Joern (Remeis-Observatory & ECAP);   KREYKENBOHM, Ingo (Remeis-Observatory & ECAP); WEBER, Philipp (ECAP/FAU); Dr DAUSER, Thomas (FAU Nürnberg); FALKNER, Sebastian (Remeis-Observatory & ECAP);   KNIES, Jonathan (FAU);   Dr RAU, Arne (MPE Garching)

Presenter(s) :   WILMS, Joern (Remeis-Observatory & ECAP)

Session Classification :   SRG Instruments and Operations

Contribution ID : **158** Type : **Poster**

The SRG-Fermi Connection

eROSITA and ART-XC on board the Spectrum-Roentgen-Gamma mission will observe some of the most efficient and powerful accelerators in the Universe, the majority of which have already been detected in gamma rays by the Fermi Large Area Telescope. In this talk I will discuss how joint SRG-Fermi studies will shed light on the most powerful accelerators.

Presenter status

Primary author(s) : AJELLO, Marco (Clemson University)

Contribution ID : **159**   Type : **Poster**

ART-XC/SRG all-sky survey: simulations and expectations

We present simulations of a four-year all-sky survey by ART-XC/SRG.

The sensitivity of the survey is predicted at the level of $\sim (1 \div 5) \times 10^{-12}$ erg s^{-1}~m^{-2}, in the 4-12 keV energy range, depending on exposure time. We expect to detect around ten thousand sources in 4-40 keV, including heavily obscured AGNs. Thus we will be able to improve the existing estimates of the fraction of such objects in the total population.These simulations allow us to do a statistical calibration of the survey and study the most effective source detection methods for both ART-XC working regimes: the standard one and as an X-ray concentrator.

Presenter status

Primary author(s) :   Dr FILIPPOVA, Ekaterina (Space Research Institute); Dr TKACHENKO, Alexey (Space Research Institute); Prof. BURENIN, Rodion (Space Research Institute)

Contribution ID : **160**   Type : **Oral Presentation**

The cosmic X-ray background and the history of the growth of black holes

Monday, 16 March 2020 14:25 (30)

The growth of supermassive black holes (SMBHs) over cosmic time is imprinted in their X-ray luminosity that is emitted from the inner central engine of active galactic nuclei (AGN). Observationally, X-rays from AGN can be probed both through deep and wide X-ray surveys, and also through the integrated emission that makes up the cosmic X-ray background (CXB). I will give an overview of our constraints on SMBH growth from X-ray and multiwavelength surveys and the CXB, focusing on the newest frontiers: AGN at the very dawn of black holes and galaxies (redshift 6 and higher) and AGN that are heavily buried by gas and dust. I will point toward the exciting potential of eROSITA, ART-XC, and future observatories in further uncovering the cosmic growth of SMBHs.

Presenter status

Invited speaker

Primary author(s) :   HICKOX, Ryan (Dartmouth College)

Presenter(s) :   HICKOX, Ryan (Dartmouth College)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : **161**   Type : **Oral Presentation**

Tidal Disruption Events

Friday, 20 March 2020 09:45 (30)

X-ray observations of Tidal Disruptions Events (TDEs) are a unique probe of the physics of accretion around supermassive black holes, as they are thought to transition from super- to sub-Eddington accretion on timescales of months/years. The first TDE candidates were found in the X-rays with the ROSAT All-Sky Survey, but, today, most of our candidates are found in the optical. While optical surveys have increased our numbers of TDE candidates enormously, it remains unclear where the optical emission originates, and if X-ray TDEs are part of the same population. Discovering TDEs in X-rays is key to understanding the emission mechanisms and rates of TDEs where the stellar debris is efficiently accreting on to the black hole. In this talk I will discuss the current state of the field, and what questions astronomers hope that eROSITA will resolve.

Presenter status

Invited speaker

Primary author(s) : KARA, Erin (MIT)

Presenter(s) : KARA, Erin (MIT)

Session Classification : Time domain and multi-messenger astronomy

Contribution ID : **163**   Type : **Oral Presentation**

eROSITA data products and data analysis software

Monday, 16 March 2020 11:50 (20)

The eROSITA Ground Segment team has developed a software package (eSASS - eROSITA Science Analysis Software System) for creating calibrated science data products and for performing various interactive data analysis tasks. The eSASS package builds on experience and in part on code from XMM-Newton and ROSAT, though with significant revisions and upgrades. eROSITA telemetry data received during each daily SRG ground contact are pipeline processed at Max-Planck-Institut für extraterrestrische Physik, creating a set of data products, such as calibrated X-ray event lists, images, exposure, background, and sensitivity maps, as well as X-ray sources catalogs and associated source-level products. These data products are made available to authorized users through a Web interface (details of the data access policy are discussed elsewhere). For in-depth interactive data analysis the eSASS package provides command-line tools performing such functions as data selection, source detection and characterization and the creation of spectra and lightcurves among others. All data products are FITS files complying with established standards such that a range of popular X-ray data analysis tools may be used. The eSASS package interacts with an eROSITA calibration database maintained by the eROSITA team.

Presenter status

eROSITA consortium member

Primary author(s) : BRUNNER, Hermann (Max-Planck-Institut für extraterrestrische Physik, Garching)

Co-author(s) : Mr GUEGUEN, Alain (MPE); GEORGAKAKIS, Antonis (NOA); MAITRA, Chandreyee (MPE); LAMER, Georg (Leibn-z Institut für Astrophysik); Dr STEWART, Ian (MPE); KREYKENBOHM, Ingo (ECAP); SANDERS, Jeremy (MPE); Dr DENNERL, Konrad (MPE); JI, Long (IAAT); Dr SALVATO, Mara (MPE); Dr FREYBERG, Michael (MPE); RAMOS CEJA, Miriam Elizabeth (MPE); WEBER, Philipp (ECAP/FAU); Ms OSTERHAGE, Sabine (MPE); CARPANO, Stefania (Max Planck Institute for Extraterrestrial Physics); FRIEDRICH, Susanne; BOLLER, Thomas (MPE Garching)

Presenter(s) : BRUNNER, Hermann (Max-Planck-Institut für extraterrestrische Physik, Garching)

Session Classification : SRG Instruments and Operations

Contribution ID : **164**   Type : **Oral Presentation**

Black Hole X-ray Binaries

Thursday, 19 March 2020 14:30 (30)

Black hole X-ray binaries represent one of the few means available for probing the supernova process, and one of the most useful means for understanding binary evolution under extreme conditions. At the present time, nearly all known black hole X-ray binaries have been selected due to luminous outbursts from their accretion disks. With eROSITA's imaging survey, it will be possible to build up a substantial sample of black holes that have never undergone an outburst, while with its time domain survey, it will become possible to identify some of the faint transient black holes that current all-sky monitors cannot see. I will discuss expected source counts, and means of identification and classification of these objects both from pure X-ray data and from multi-wavelength follow-up.

Presenter status

Invited speaker

Primary author(s) :   Prof. MACCARONE, Thomas (Texas Tech University)

Presenter(s) :   Prof. MACCARONE, Thomas (Texas Tech University)

Session Classification :   X-ray view of the Milky Way: Compact Objects

Contribution ID : **165** Type : **Oral Presentation**

Stars in the e-ROSITA eyes

Thursday, 19 March 2020 10:25 (30)

Massive stars of basically all spectral types emit X-rays. Despite tremendous efforts undertaken in the last 20 years, the exact physical mechanisms responsible for their X-ray emission are still not fully understood. The eROSITA survey will deliver a clear X-ray view of massive stars within 2 kpc from the sun. eROSITA's sensitivity in the hard band will become a key diagnostic tool to detect and study massive stars in binaries as well as massive stars with magnetic fields. These stellar properties are of pivotal importance for stellar evolution. Massive stars are the progenitors of neutron stars and black holes. The eROSITA survey strategy is optimally suited to detect X-ray transients, and will deliver much better statistics on massive stars with degenerate companions. This is especially important in the era of gravitational wave astronomy. The results of eRASS will, without doubt, farther motivate population syntheses and detailed studies of evolutionary paths from massive binaries towards double degenerate binaries. In this talk I will briefly review our current knowledge about the X-ray properties of massive star and high-mass X-ray binary populations, and outline what we hope to learn from the results of the eROSITA survey.

Presenter status

Invited speaker

Primary author(s) : Dr OSKINOVA, Lidia (Potsdam University)

Presenter(s) : Dr OSKINOVA, Lidia (Potsdam University)

Session Classification : X-ray view of the Milky Way: Stars

Contribution ID : **166** Type : **Oral Presentation**

X-ray Studies of Supernova Remnants

Thursday, 19 March 2020 11:25 (30)

Modern X-ray telescopes have revealed the exquisite detail and complexity of supernova remnants (SNRs) at high energies. The metals synthesized in explosions are X-ray bright for many thousands of years, and Chandra, XMM-Newton, Suzaku, and NuSTAR have offered an up-close view of the nucleosynthetic products and their dispersal into the interstellar medium (ISM). In this talk, I will review the major advances facilitated by X-ray observations of SNRs, particularly regarding the nature of explosions, progenitor stars, and particle acceleration. I will also discuss the exciting future prospects for SNR studies, particularly with SRG and X-ray microcalorimeters.

Presenter status

Invited Speaker

Primary author(s) : LOPEZ, Laura (Ohio State University)

Presenter(s) : LOPEZ, Laura (Ohio State University)

Session Classification : X-ray view of the Milky Way: SNe and the ISM

Contribution ID : **167** Type : **Oral Presentation**

The SRG/eROSITA view of the W50/SS433

Thursday, 19 March 2020 12:35 (20)

We will present a full-color X-ray view of the radio nebula W50 which harbors the remarkable Galactic microquasar SS 433 provided by SRG/eROSITA. This system is a unique showcase of the impact that sources with hyper Eddington accretion rates might have on their environments, featuring jets, shocks, particle acceleration to Very High Energies and more. An unprecedentedly sensitive and complete X-ray data allow us to identify a number of intricate details highlighting various aspects of the rich multi-component interaction. In future, the presented data will serve as a baseline for combining multiwavelength observations and building a complete physical picture of this "extreme ISM laboratory".

Presenter status

SRG/eROSITA/RU consortium member

Primary author(s) : KHABIBULLIN, Ildar (IKI/MPA); ON BEHALF OF THE SRG/EROSITA RUSSIAN CONSORTIUM

Presenter(s) : KHABIBULLIN, Ildar (IKI/MPA)

Session Classification : X-ray view of the Milky Way: SNe and the ISM

Contribution ID : **168**   Type : **Oral Presentation**

Optical confirmation of eROSITA selected clusters

Tuesday, 17 March 2020 10:05 (15)

X-ray surveys such as those conducted by eROSITA are a powerful way to identify large numbers of galaxy clusters. But cluster candidates identified by eROSITA need additional confirmation and redshifts to provide a clean cluster catalog that can be used for science.
Modern optical imaging surveys such as HSC, DES and the Legacy Survey cover large fractions of the eROSITA extragalactic sky and provide depths that are sufficient to identify eROSITA clusters out to z~1.1.
In this talk we present methods and first results of the optical identification of eROSITA clusters. The main focus of this presentation will be on the confirmation, redshift estimation and measurement of the basic optical properties of cluster candidates found in the eROSITA Final Equatorial-Depths Survey (eFEDS).

Presenter status

eROSITA consortium member

Primary author(s) : KLEIN, Matthias (LMU); Prof. MOHR, Joseph (LMU); Prof. OGURI, Masamune (University of Tokyo)

Presenter(s) : KLEIN, Matthias (LMU)

Session Classification : Clusters and Cosmology I

Contribution ID : **169**   Type : **Oral Presentation**

Optical identifications of SRG X-Ray sources by using RTT-150 observations

Monday, 16 March 2020 18:10 (15)

In this report we will present first results of the optical identifications by using 1.5-m Russian-Turkish telescope of the sample of X-Ray sources detected with eRosita and ART-XC onboard SRG in the Lockman Hole region during PV period in November 2019. We will inform also results of SRG orbit's astrometric support observations by using RTT-150 in the period July 2019 - February 2020.

Presenter status

ART-XC consortium members, Russian SRG/eRosita consortium members

Primary author(s) :   Prof. BIKMAEV, Ilfan (Kazan Federal University, Kazan, Russia); Prof. SUN-YAEV, Rashid (IKI RAS (Moscow), MPA (Germany)); Prof. GILFANOV , Marat (IKI RAS (Moscow), MPA (Germany)); Prof. PAVLINSKY, Mikhail (IKI RAS (Moscow)); Dr BURENIN, Rodion (IKI RAS (Moscow))

Presenter(s) :   Prof. BIKMAEV, Ilfan (Kazan Federal University, Kazan, Russia)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : **170**   Type : **Oral Presentation**

The SRG/eROSITA view of the Coma cluster

Tuesday, 17 March 2020 15:25 (20)

One of the X-ray brightest clusters – A1656 (Coma) – was observed during the PV program for 2 days covering the cluster up to its virial radius and beyond. We will present the results of imaging and spectral analysis of these data and immediate implication for the cluster studies with SRG/eROSITA.

Presenter status

SRG/eROSITA/RU consortium member

Primary author(s) :   Dr CHURAZOV , Eugene (IKI/MPA);   ON BEHALF OF THE SRG/EROSITA RUSSIAN CONSORTIUM

Presenter(s) :   Dr CHURAZOV , Eugene (IKI/MPA)

Session Classification :   Clusters and Cosmology II

Contribution ID : **171**   Type : **Oral Presentation**

Accurate photo-z measurements for X-ray AGNs discovered by SRG/eRosita in the Lockman Hole field

We present results of cosmological redshift measurements for X-ray AGNs discovered by eRosita in the Lockman Hole extragalactic field during the SRG PV-phase survey. Photometric redshifts and related classification (absorbed/unobsorbed AGN) of X-ray sources were performed by machine learning photo-z models implemented in SRGz package. We discuss the importance of different photometric data from modern sky surveys (GAIA, SDSS, PanSTARRS, Legacy Surveys, WISE) in reaching the goal of high accuracy and low outlier rate photo-z predictions.

Presenter status

eROSITA/RU consortium member

Primary author(s) :   Dr MESHCHERYAKOV, Alexander (IKI)

Presenter(s) :   Dr MESHCHERYAKOV, Alexander (IKI)

Contribution ID : **172**   Type : **Oral Presentation**

eROSITA early phase and commissioning operations

Monday, 16 March 2020 10:10 (15)

The cruise phase of SRG to L2 was used to verify that all eROSITA systems had survived launch and no degradation in the functionality was present. The critical one-time operations of opening the telescope cover and cooling the CCD detectors to -90℃ were also carried out during this phase. This talk presents an overview of the telescope operations during the commissioning phase that verified functionality of thermal and electrical systems and commissioned the CCD cameras before the important Calibration and Pointed Verification phase started. It reports on challenges encountered and summarizes the results from this phase.

Presenter status

Primary author(s) :   COUTINHO, Diogo (MPE)

Co-author(s) :   Dr MEIDINGER, Norbert (MPE); Ms HARTNER, Gisela (MPE); Mr KINK, Walter (MPE); Mr MUELLER, Siegfried (MPE); Dr PREDEHL, Peter; Mr BORNEMANN, Walter (MPE); Dr FREYBERG, Michael (MPE); Dr KONRAD, Dennerl (MPE); Mr FEDOR, Korotkov (IKI); Mr BOGO-MOLOV, Andrei (IKI); Mr NAZAROV, Vladimir (IKI); Dr BRUNNER, Hermann (MPE)

Presenter(s) :   COUTINHO, Diogo (MPE)

Session Classification :   SRG Instruments and Operations

Contribution ID : **173**   Type : **Poster**

The high-redshift obscured accretion of supermassive black holes through X-rays eyes: recent results and potential developments

I will discuss our current knowledge of the very high redshift Universe, with a particular focus on the results recently obtained by the Chandra J1030 survey, whose depth allowed us to reach fluxes faint enough to explore a population of obscured high-z AGNs, searching for evolutionary trends of the AGN obscured fraction.

I will then present what the next generation of X-ray instruments (particularly AXIS and Athena) would be able to achieve in terms of characterizing the very high-z, heavily obscured AGNs, and how these facilities will nicely complement the results which eRosita will obtain in the 2020s.

Presenter status

External collaborator

Primary author(s) :   MARCHESI, Stefano (INAF-OAS Bologna)

Contribution ID : **174** Type : **Oral Presentation**

First results of the SRG/eROSITA Galactic Plane survey at l=20

Thursday, 19 March 2020 17:30 (15)

We will present the first results of a deep raster-scan
observation of the Galactic plane field, carried out by the
SRG/eROSITA telescope as a part of its CalPV program.
The field is centered at Galactic longitude l=20 degrees and covers a
total area of 25 sq. deg with a mean exposure of 8 ksec. We have
detected more than 2000 individual point X-ray sources,
demonstrating a wide variety of spectral properties, many of them having
counetrparts in GAIA and other optical catalogs. We will
present the log N(>S) - log S distributions of detected sources, their spectral
properties and discuss the overall picture of the Galactic X-ray source population.

Presenter status

member of Russian SRG/eRosita consortium

Primary author(s) : Mr MEDVEDEV, Pavel (Space Research Institute (IKI), Moscow)

Presenter(s) : Mr MEDVEDEV, Pavel (Space Research Institute (IKI), Moscow)

Session Classification : X-ray view of the Milky Way: Compact Objects

Contribution ID : **175**   Type : **Oral Presentation**

Cluster Surveys and Cosmology with the Sunyaev-Zel'dovich Effect

Tuesday, 17 March 2020 11:20 (30)

I will give an overview of Sunyaev-Zel'dovich (SZ) cluster surveys, the resultant cosmological constraints, and projected future results. Since the first SZ-discovered cluster in 2008, there are now over 1500 SZ-selected clusters reported in the literature. Ongoing surveys from AdvACT and SPT-3G promise to deliver samples with several thousand additional clusters in the next few years, with the future CMB-S4 experiment expected to find over 100,000 clusters. These data sets promise to deliver unique samples of massive clusters at z > 1, including proto-clusters detected at z > 4 from their mm-wave emission The resultant cosmological constraints from the cluster number density will require an understanding of the cluster selection and mass calibration, which will rely on multi-wavelength data from overlapping X-ray and optical surveys that will enable additional cosmological studies. I will summarize these upcoming results, challenges, and projected cosmological constraints.

Presenter status

Invited Speaker

Primary author(s) : BENSON, Bradford (Fermilab, University of Chicago)

Presenter(s) : BENSON, Bradford (Fermilab, University of Chicago)

Session Classification : Clusters and Cosmology I

Contribution ID : **176** Type : **Oral Presentation**

Welcome and Introduction

Monday, 16 March 2020 09:10 (20)

Presenter status

Presenter(s) : PREDEHL, Peter (Max-Planck-Institut für Exteraterrestrische Physik)

Session Classification : SRG Instruments and Operations

Contribution ID : **177** Type : **Oral Presentation**

SRG Orbital Observatory: scientific goals and recent results

Monday, 16 March 2020 09:30 (20)

Presenter status

Presenter(s) : Prof. SUNYAEV, Rashid (IKI RAS (Moscow), MPA (Germany))

Session Classification : SRG Instruments and Operations

Contribution ID : **178**   Type : **Oral Presentation**

SRG Status and Operations

Monday, 16 March 2020 09:50 (20)

Presenter status

Presenter(s) :   LOMAKIN, Ilya (NPOL Lavochkin)

Session Classification :   SRG Instruments and Operations

Contribution ID : **179** Type : **Oral Presentation**

SRG/eROSITA early phase and commissioning operations

Presenter status

Primary author(s) : COUTINHO, Diogo (MPE)

Presenter(s) : COUTINHO, Diogo (MPE)

Session Classification : SRG Instruments and Operations

Contribution ID : **180**   Type : **Oral Presentation**

The Future of High Energy Stellar Physics

Thursday, 19 March 2020 09:00 (30)

eROSITA is poised to unleash a deluge of information on the stellar X-ray sky in a nexus with other powerful complementary missions and capabilities, such as TESS, Gaia and LSST. I will endeavour to provide a brief overview of the outstanding problems in high energy stellar physics, and the status of our knowledge deep into the Chandra and XMM-Newton era. I will describe some important aspects that eROSITA can tackle, and possibly solve, from probing the distributions of hidden massive young stellar clusters to stellar X-ray population synthesis and understanding magnetic dynamos and the evolution of stellar energetic radiation.

Presenter status

Primary author(s) : DRAKE, Jeremy (Smithsonian Astrophysical Observatory)

Presenter(s) : DRAKE, Jeremy (Smithsonian Astrophysical Observatory)

Session Classification : X-ray view of the Milky Way: Stars

Contribution ID : **181** Type : **Oral Presentation**

An optical identification of the SRG sources of the Lockman Hole PV-phase survey

Monday, 16 March 2020 17:25 (15)

We discuss the first results of the optical identification the SRG X-ray sources of the 18.5 square degrees Lockman Hole PV-phase survey. We show first spectroscopically confirmed quasar candidates at z~4 the spectra of which were obtained at the 1.6-m telescope AZT-33IK and the 6-m telescope BTA.
We review a fraction of optical identification of X-ray sources in the several wide field broad band photometric surveys: SDSS, Pan-STARRS, DESI Legacy Survey.

Presenter status

eROSITA RU consortium member

Primary author(s) : Dr KHORUNZHEV, Georgii (IKI RAS); Dr MESCHERYAKOV, Alexander (IKI RAS); Dr MEDVEDEV, Pavel (IKI RAS)

Co-author(s) : Prof. GILFANOV, Marat (IKI RAS); Prof. SAZONOV, Sergey (IKI RAS); Prof. BURENIN, Rodion (IKI RAS)

Presenter(s) : Dr KHORUNZHEV, Georgii (IKI RAS)

Session Classification : AGN Surveys and the history of accretion

Contribution ID : **182**   Type : **Oral Presentation**

From eFEDS to the All Sky Survey: Cluster Science and Cosmology with eROSITA

Tuesday, 17 March 2020 09:30 (20)

Presenter status

Primary author(s) :   Dr BULBUL, Esra (MPE)

Presenter(s) :   Dr BULBUL, Esra (MPE)

Session Classification :   Clusters and Cosmology I

Contribution ID : **183**   Type : **not specified**

The Coma-NGC 4839 merger scenario in the light of new SRG/eROSITA data

Tuesday, 17 March 2020 15:45 (15)

Presenter status

Primary author(s) :   LYSKOVA, Natalia (IKI (Moscow))

Presenter(s) :   LYSKOVA, Natalia (IKI (Moscow))

Session Classification :   Clusters and Cosmology II

Contribution ID : **184** Type : **Oral Presentation**

TBD

Friday, 20 March 2020 11:30 (30)

Presenter status

Primary author(s) : KOWALSKI, Marek (DESY and Humboldt University Berlin)

Presenter(s) : KOWALSKI, Marek (DESY and Humboldt University Berlin)

Session Classification : Time domain and multi-messenger astronomy

Contribution ID : **185** Type : **Oral Presentation**

Synergies between XRISM and SRG/eROSITA

Friday, 20 March 2020 12:45 (20)

Presenter status

Primary author(s) : GUAINAZZI, Matteo (ESA)

Presenter(s) : GUAINAZZI, Matteo (ESA)

Session Classification : Time domain and multi-messenger astronomy

Contribution ID : **186**   Type : **Oral Presentation**

Tracing the Origin of Seed Black Holes in the Universe

Monday, 16 March 2020 16:55 (30)

Nearly all galaxies appear to harbor a supermassive black hole. The origin and properties of initial black hole seeds that grow to produce the detected supermassive black hole population are unconstrained at present, as actively growing seeds are not directly observable near their birth epochs. Nevertheless, some unique signatures of seeding survive and can be discerned in: local scaling relations between black holes and their galaxy hosts at low-masses; in high-redshift X-ray and optical luminosity functions of accreting black holes; and in the total number and mass functions of gravitational wave coalescence events from merging binary black holes. I will describe several of these newly proposed observables that encapsulate information about seeding and permit disentangling the confounding effects of subsequent growth, merging and evolution. With exciting prospects for the availability of multi-wavelength (X-ray, Infra-Red, Optical) and multi-messenger data, we stand to trace the origin of the first black holes.

Presenter status

INVITED SPEAKER

Primary author(s) :   Prof. NATARAJAN, Priyamvada (Yale University)

Presenter(s) :   Prof. NATARAJAN, Priyamvada (Yale University)

Session Classification :   AGN Surveys and the history of accretion

Contribution ID : **194** Type : **Poster**

Studying the simultaneous X- and Gamma-ray Emission of Blazars

Blazars show a highly variable emission across the whole electromagnetic spectrum, ranging from minutes to years. The physics origin of this variability is yet unclear, and seems likely to be linked to the underlying particle accelerations mechanisms in the jet. Combined simultaneous or quasi-simultaneous flux measurements at different wavelength bands have the potential to shed light on these underlying physics mechanisms.

We will investigate the high-energy emission of blazars by combining and correlating their fluxes and - when possible - their energy spectra as measured by eROSITA at X-rays (1-10 keV) with simultaneously or quasi-simultaneous multiwavelength data, in particular with the Fermi/LAT Gamma-ray (> 100 MeV) data, for the observed blazars. The compiled source list of promising blazars, the analysis methods and some early results will be presented.

Presenter status

eROSITA consortium member

Primary author(s) : Dr COLLMAR, Werner (MPE); Prof. WILMS , Jörn (Dr. Karl-Remeis-Sternwarte Bamber); Prof. BUSON, Sara (Universität Würzburg)