Day 1, morning, session 1: General information (chair: Didier Barret)

Luigi Stella

Overview of the LOFT Science

Jan-Willem den Herder/Marco Feroci

Latest evolutions of the LOFT mission

Anna Heras

Status of the M3 missions at ESA

Day 1, morning, session 2: Neutron star session (chair: Enrico Bozzo)

Anna Watts

LOFT 'Dense Matter' Science Group activities

Frederick K. Lamb

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Using energy-resolved waveforms of X-ray burst oscillations to determine neutron star masses and radii

Abstract Precise, simultaneous measurements of the mass M and radius R of neutron stars can yield uniquely valuable information about the still uncertain properties of cold matter at several times the density of nuclear matter. One method that could be used to measure M and R is to analyze the energy-dependent waveforms of the X-ray flux oscillations seen during some thermonuclear bursts from some neutron stars. These oscillations are thought to be produced by X-ray emission from hot gas at the surface of the star that has been heated by the energy released during thermonuclear burning and is rotating at or near the spin frequency of the star. Using synthetic energy-dependent waveforms, a Bayesian approach, and Markov Chain Monte Carlo sampling methods, we have analyzed in detail the constraints on M and R that could be obtained by analyzing energy-resolved measurements of burst oscillation waveforms made using a future, satellite-borne detector with 2-30 keV energy coverage and an effective area 10 to 20 times larger than the RXTE PCA. In particular, we have

determined the likelihood distributions for all the parameters in our standard model, given the synthetic waveform data corresponding to a variety of hot spot and observer inclinations and stellar spin rates. The parameters in this model are M and R; the inclinations of the hot spot and the observer; the temperature of the emission, which is assumed to have a blackbody spectrum; the angular diameter of the hot spot, which is assumed to be uniform and circular; the distance to the star; and the stellar spin rate, which is assumed to be known from other measurements. We then determined the 1-sigma and 3-sigma confidence regions in the M-R plane for a neutron star with a known spin rate, by marginalizing the other parameters in the model. We have also explored the dependence of the extent and position of these confidence regions on the background count rate and on deviations in the actual shape of the hot spot and the actual spectrum of the emission from those assumed in the model. Finally, we have explored the effect on the confidence regions if the distance to the star or the inclination of the observer are known from other measurements, or if a resonance scattering line is observed in the burst oscillation spectrum. In this talk, we summarize our findings. The results presented here are based on research supported by NSF grant AST0709015 and funds of the Fortner Endowed Chair at the University of Illinois, and by NSF grant AST0708424 at the University of Maryland.

Stratos Boutloukos

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Model atmosphere fits to superburst spectra and implications for neutron star mass and radius determinations

Abstract Analysis of X-ray burst observations has long been considered a possible method for constraining the masses and radii of some neutron stars. The standard approach is based on a number of assumptions about the burst emission, including that the emitting area is constant and equal to the surface area of the entire star and that the spectra are accurately described by a particular, detailed stellar atmosphere spectral model or even, in some cases, that the spectra can be adequately described by blackbody spectra. We test these assumptions for the first time using the highest quality X-ray spectra that are currently available and explore what woud be possible using a future instrument with the capabilities planned for LOFT. We find that RXTE PCA spectra of the 4U 1820-30 superburst obtained during an interval of 1600 seconds following the peak of the burst are clearly better fit by the most recent, detailed atmospheric spectral models of Suleimanov et al. than by simple thermal spectral models or other available detailed atmospheric spectral models. Our analysis of this superburst is the first analysis that makes such a comparison meaningful, because PCA observations of ordinary bursts that last only a few seconds do not provide enough counts to discriminate between even very different spectral models. We also find that the emitting area of the superburst decreased by 20% during the interval we studied, and may never have included the entire surface. This result is inconsistent with a basic assumption of previous analyses, which is that the entire stellar surface emits uniformly during tails of bursts. Finally, we explore the constraints that would be possible if a superburst is observed using an instrument with the planned capabilities of the LOFT LAD. We do this by synthesizing a sequence of superburst spectra, folding them through the LAD response matrix, and then fitting model spectra to them. As Majczyna & Madej (2005) first suggested, accurate fits of detailed spectral models that are sufficiently precise to determine accurately both the surface gravity and the surface redshift would allow estimates of the stellar mass and radius that are independent of the distance to the source and the absolute flux calibration of the instrument. Use of this method would require accurate knowledge of the energy dependence of the effective area and would be affected by other possible systematic effects. We discuss the prospects for using LOFT data to constrain neutron star masses and radii using this method. Constraints obtained in this way would provide independent checks on constraints obtained using complementary methods.

Day 1, afternoon, session 1: Neutron star session - cont. (chair: Anna Watts)

Tod Strohmayer

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Burst Oscillation Probes of Neutron Stars and Nuclear Burning with LOFT

Abstract X-ray brightness oscillations during thermonuclear X-ray bursts–burst oscillations–have provided a new probe of neutron star spins as well as time dependent nuclear burning processes. The frequency drift and amplitude evolution of the oscillations observed during bursts can in principle place constraints on the physics of thermonuclear flame spreading and the dynamics of the burning atmosphere. I use simulations appropriate to LOFT to explore the precision with which the time dependence of the oscillation frequency can be inferred. This can test, for example, different models for the frequency drift, such as up-lift versus geostrophic drift. I also explore the precision with which asymptotic frequencies can be constrained in order to estimate the capability for LOFT to detect the Doppler shifts induced by orbital motion of the neutron star from a sample of bursts at different orbital phases.

Dimitrios Psaltis

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Breaking the Degeneracies in Measuring Neutron Star Properties

from Pulse Profile Modeling

Abstract One of the key science goals for the LOFT mission is to measure the masses and radii of a number of neutron stars by fitting the profiles of the oscillations observed during the rise phases of their X-ray bursts. For slowly spinning neutron stars, it is well known that this procedure leads to very strong degeneracies between the various parameters of interest. In particular, pulse profile modeling for slowly spinning neutron stars constrains predominantly the mass-to-radius ratio of the neutron star and results in broad correlated uncertainties in the determination of the colatitude of the hot spot and the inclination of the observer. In this talk, I show how this limitation can be overcome in the case of neutron stars spinning at moderate rates (300-600 Hz), as the Doppler shifts introduced by the stellar rotation lead to a characteristic evolution of the X-ray spectrum during the oscillation phase that depends primarily on the radius of the neutron star and not on its compactness. I will use this to demonstrate that combining the modeling of bolometric pulse profiles with the phase dependence of an appropriately defined X-ray color breaks the above degeneracies and leads to independent measurements of neutron-star masses and radii. I will also provide estimates of the required energy resolution and effective area for the LOFT detectors that are necessary to achieve accurate measurements of the masses and radii of the five brightest X-ray bursters.

Andrew W. Steiner

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Determining the Equation of State from Neutron Star Masses and Radii

Abstract We determine the neutron star mass-radius relation and, based on recent observations of both transiently accreting and bursting sources, we show that the radius of a 1.4 solar mass neutron star lies between 10.4 and 12.9 km, independent of assumptions about the composition of the core. We show, for the first time, that these constraints remain valid upon removal from our sample of the most extreme transient sources or of the entire set of bursting sources; our constraints also apply even if deconfined quark matter exists in the neutron star core. Our results significantly constrain the dense matter EOS and are, furthermore, consistent with constraints from both heavy-ion collisions and theoretical studies of neutron matter. Nevertheless, there are still several important systematic uncertainties which are not well understood, and we discuss how these uncertainties may continue to limit radius measurements and constraints on the EOS.

Alessandro Drago

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HIgh density matter in labs and in stars

Abstract I will give an overview of the experimental situation concerning the Equation of State of matter as tested in heavy ion collisions in the labs. Strong indications exist about a significant softening of the EoS as tested at energies ranging from a few GeV per nucleon up to a few tens GeV per nucleon. This softening can be a indication of a phase transition, either associated with chiral symmetry restoration or to quark deconfinement. I will present theoretical scenarios able to describe the experimental findings and I will also discuss the problems arising when trying to use these experimental data to put limits to the EoS of matter in neutron stars. 1) V. N. Russkikh and Y. B. Ivanov, Phys. Rev. C 74, 034904 (2006). 2) L. Bonanno, A. Drago and A. Lavagno, Phys. Rev. Lett. 99, 242301 (2007). 3) M. Di Toro, A. Drago, T. Gaitanos, V. Greco, A. Lavagno Nucl. Phys. A 775, 102 (2006). 4) L. McLerran and R. D. Pisarski, Nucl. Phys. A 796, 83 (2007). 5) A. Drago and V. Mantovani Sarti, arXiv:1109.5399, in print on Phys. Rev. C. 6) A.V. Merdeev, L.M. Satarov and I.N. Mishustin, arXiv:1103.3988

Day 1, afternoon, session 2: Neutron star session - cont. (chair: Anna Watts)

Sharon Morsink

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Probing Relativistic Gravitational Fields with Neutron Stars

Abstract Neutron stars have strong gravitational fields and densities larger than nuclear. Their small size and large average densities allow them to spin at very rapid rates, with surface velocities that are a large fraction of the speed of light. The very large gravitational fields and relativistic rotation rates make it necessary to use Einstein's theory of general relativity to describe these stars. As a result, neutron stars have great potential to act as laboratories for strong field relativistic effects. In this talk, I will review some of the interesting effects that may be observed by LOFT and discuss the prospects for constraining the unknown nuclear equation of state describing these dense stars.

Sudip Bhattacharyya

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Probing dense matter using relativistic disk lines

Abstract Modeling of relativistic spectral lines from the accretion disk of a neutron star low-mass X-ray binary can be useful to measure the disk inner edge radius. A small value of this radius tentatively implies that the disk terminates either at the neutron star hard surface, or at the innermost stable circular orbit (ISCO). Therefore a measured disk inner edge radius either provides the stellar radius, or can directly constrain stellar equation of state (EoS) models using the theoretically computed ISCO radii. However, this procedure requires numerical computation of stellar and ISCO radii for various EoS models and neutron star configurations using an appropriate rapidly spinning neutron star space–time. We have fully general relativistically calculated many stable neutron star structures to explore the above mentioned procedure. We will discuss the degree of accuracy in the measurements of disk inner edge radii required to constrain the EoS models, and whether LOFT will be able to achieve it.

Alessandro Papitto

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Broad iron lines from accreting ms pulsars, as observed by LOFT

Abstract The sensitivity and spectral resolution of XMM-Newton and Suzaku have recently shown how the innermost regions of the disc around a quickly rotating, accreting ms pulsar, can be probed by reflection features such as broadened iron K lines. The possibility of estimating where the accretion disc is truncated by the neutron star magnetosphere makes these accreting pulsars very appealing cases to study disc reflection. The broad iron line observed from the class prototype, SAX J1808.4-3658, as well as recent results about the intermittent pulsar, HETE J1900.1-2455, will be presented. At the same time, simulations of the dramatic contribution given by LOFT to this area of research will be shown, highlighting how its combination of extremely large effective area and mild spectral resolution will allow to effectively measure how the magnetosphere reacts to variations of the accretion rate, as a function of the neutron star magnetic field.

Michi Baubock

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Continuum and Line Spectra of Moderately Spinning Neutron Stars

Abstract Neutron stars spinning at moderate rates (300-600 Hz) become oblate in shape and acquire a nonzero quadrupole moment. We consider how these two properties affect the apparent surface area of a neutron star that is emitting thermally as well as the profiles of atomic features that originate on its surface. We use a new ray-tracing algorithm that allows us to model the appearance of a neutron star in the Hartle-Thorne metric. This metric is formally correct to second order in the neutron-star spin and depends only on the macroscopic properties of the star, not on the details of its equation of state. We show that the oblateness and quadrupole moment of the star have a small influence on its apparent surface area. Atomic surface features, on the other hand, are strongly affected by the oblateness of the star and the quadrupole moment of the spacetime. Line profiles acquire cores that are much narrower than the widths expected from pure Doppler effects for a large range of observer inclinations. The presence of these narrow cores substantially increases the likelihood of detecting atomic lines with LOFT, given its large collecting area. This is true even when the equivalent widths are expected to be small, as in the case of weakly magnetic accreting neutron stars.

Day 2, morning, session 1: Strong gravity (chair: Luigi Stella)

Didier Barret

LOFT 'Strong Gravity' Science Group activities

Andy Fabian

AGN strong gravity with LOFT

Alessandra De Rosa

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A deep insight into strong gravity around supermassive black holes with LOFT

Abstract Thanks to its sensitivity, broad energy range and (almost) CCD-class energy resolution, LOFT will be able to determine with very high signal to noise and accurate continuum subtraction the profile the Fe K-lines in AGN. In this talk we will present detailed simulations showing that LOFT-LAD will

observe broad Fe line in AGN up to 1 mCrab flux, measuring the inner radius of the disk down to the marginally stable orbit and, from this, derive the spin of the BH (10% accuracy for fast spin). Moreover the very high throughput of LOFT will permit to investigate the Fe line response to flares, and reveal the orbital motion of individual blobs providing BH mass and spin with 25% and 20% accuracy. We will also present a comparison of the LOFT performance with those available today with XMM-Newton and NuStar combined observations.

Phil Uttley

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Mapping the extreme: X-ray reverberation in X-ray binaries

Abstract The high time-resolution and high-throughput offered by LOFT will allow us to measure energy-dependent time delays in X-ray binary systems down to the sub-microsecond level. Combined with the CCD spectral-resolution offered by the revolutionary LAD detectors, this unprecedented capability will allow us to use the light-travel time echoes in these systems to 'reverberation map' the regions with the strongest space-time curvature and strongest magnetic fields in the universe. I will show how X-ray reverberation measurements of X-ray binary systems with LOFT will enable us to map the innermost structure of accretion flows, observe directly the light-bending effects of strong-gravity, measure black hole masses and spins and constrain the neutron star equation of state.

Day 2, morning, session 2: Strong gravity - cont. (chair: Luigi Stella)

Michiel van der Klis

QPOs and noise as probes of strong field gravity

Adam Ingram

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Using LOFT to uncover the QPO mechanism in X-ray binaries

Abstract Low frequency quasi-periodic oscillations (QPOs) seen in many black hole and neutron star binaries have the potential to be very powerful diagnostics of the inner accretion flow. However, this potential cannot be realised without a quantitative model for the QPO. It has recently been shown that the same truncated disc/hot inner flow geometry which is used to interpret the spectral transitions can also directly produce the QPO from Lense-Thirring (vertical) precession of the hot inner flow. Here I show that this model gives a unique prediction in its iron line signature. A tilted flow illuminates different azimuths of the disc as it precesses. The iron line arising from this rotating illumination is blue shifted when the flow irradiates the approaching region of the spinning disc and red shifted when the flow irradiates the receding region of the disc. This gives rise to a characteristic rocking of the iron line on the QPO frequency which is a necessary and sufficient test of a Lense-Thirring origin. I show that LOFT will allow us to measure this effect with precision, thus providing definitive evidence for (or against) the Lense-Thirring model and solving the 25 year mystery of low frequency QPOs.

Tomaso Belloni

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High-frequency Quasi-Periodic Oscillations from Black Hole Binaries

Abstract Sixteen years of observations of black-hole binaries with the Rossi X-Ray Timing Explorer have given us a large database which will be unequalled for many years. Despite the large number of observations, only a handful of them allowed the detection of high-frequency (¿30 Hz) features in the Power Density Spectra. These signals are thought to be directly connected to the effects of General Relativity in the strong field regime. I will present the results of a systematic analysis of the full archive and review the main properties of the existing significant signals, examining prospects for LOFT.

Tim Johannsen

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Testing the No-Hair Theorem with LOFT

Abstract According to the no-hair theorem, black holes are fully described by their masses and spins. In this talk, I will discuss a framework for observational tests of the no-hair theorem in terms of a Kerr-like spacetime that contains a free parameter which measures potential deviations from the Kerr metric. I will show how LOFT can test the no-hair theorem with observations of quasi-periodic variability and relativistically broadened iron lines in galactic black holes. I will present current constraints on violations of the no-hair theorem using RXTE QPO data and identify the required precision to perform this

test with LOFT.

Day 2, afternoon, session 1: Observatory Science (chair: Alessandra de Rosa)

Joern Wilms

LOFT 'Observatory Science' Group activities

Iossif Papadakis

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X-ray variability studies of AGN

Abstract I will present recent results, and will discuss various ideas, related to the AGN X-ray flux and spectral variability, which address the nature of the X-ray source in these objects, the physical conditions around the central source, and can also be used to determine basic properties of these objects, such as the mass of the central black hole. I will discuss in detail the possible contribution of LOFT to the advancement of our knowledge in this field.

Tom Maccarone

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Observatory Science with LOFT

Abstract I will give a whirlwind tour of the variety of scientific areas to which LOFT can contribute which extend beyond its core science goals of understanding strong gravity and the neutron star equation of state. I will attempt to emphasize the areas which might attract support from parts of the astronomical community which are not typically strongly interested in X-ray timing missions. I will develop a few topics in a bit greater detail than the others, with the final decision on those to be made based on the other talks being presented at the meeting.

Day 2, afternoon, session 2: Observatory Science - cont. (chair: Alessandra de Rosa)

Patrizia Romano

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Investigating Supergiant Fast X-ray Transients with LOFT

Abstract Supergiant Fast X-ray Transients are HMXBs with OB supergiant companions, known for hour-long X-ray outbursts during which their luminosity increases by 3–5 orders of magnitude. Thanks to its coded mask Wide Field Monitor (WFM) and its 10-m^2 class collimated X-ray Large Area Detector (LAD), LOFT will dramatically deepen the knowledge of this class of sources. It will provide simultaneous high S/N broad-band and time-resolved spectroscopy in several intensity states, long term monitoring that will yield new determinations of orbital periods, as well as spin periods. The WFM will detect all SFXT flares within its field of view down to a 15-20 mCrab in 5 ks. We show the results of an extensive set of simulations performed with the most recent LOFT responses, which are based on the Swift broad-band data and detailed XMM-Newton observations we collected up to now. Our simulations describe the outbursts at several intensities ($F_{(2-10\,\mathrm{keV})} = 5.9 \times 10^{-9}$ to 5.5×10^{-10} erg cm^{-2} s^{-1}), the intermediate and most common state 10^{-11} erg cm^{-2} s^{-1}), and the low state (1.2×10^{-12} to 5×10^{-13} erg cm^{-2} s^{-1}). We also show how the LAD and WFM will be particularly well suited to study the large variations of NH and the presence of emission lines, that characterize the Swift and XMM spectra recorded in different occasions from several SFXT sources.

Colleen Wilson-Hodge

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Be/X-ray Binaries with LOFT

Abstract The combination of a sensitive wide-field monitor (WFM) and large area detector (LAD) on LOFT will enable new detailed studies of accretion powered pulsars which I will review, focusing primarily on contributions from WFM observations. RXTE observations have shown an unusually high number of Be/X-ray pulsar binaries in the SMC. Unlike binaries in the Milky Way, these systems are all at the same distance, allowing detailed population studies using the sensitive LOFT WFM, potentially providing connections to star formation episodes. For Galactic Be/X-ray binaries, recent monitoring has shown several outbursts that do not fit the simple giant/normal outburst picture, including intermediate strength outbursts, double-peaked outbursts, and outbursts that

shift in orbital phase. Previous all-sky monitors have not been capable of simultaneously measuring the timing properties and the broad-band flux of these systems. The WFM will enable these measurements and measurements of quasi-periodic oscillations during these outburst which will allow tests of accretion theory and provide constraints on the magnetic field and neutron star parameters for these systems.

Domitilla de Martino

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LOFT Observatory Science: Accreting White Dwarf Binaries

Abstract The Loft capabilities to study temporal and spectral properties of accreting white dwarf binaries will be presented.

Day 3, morning, session 1: Observatory Science - cont. (chair: Margarita Hernanz)

Nanda Rea

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Magnetars: neutron stars with huge storm

Abstract The properties of matter under the influence of magnetic fields and the role of electromagnetism in physical processes are key areas of research in physics, biology, bioengineering, chemistry, geology and many other branches of science. Among the many different classes of stellar objects, neutron stars provide a unique environment where we can test (at the same time) our understanding of matter with extreme density, temperature, and magnetic field. In this talk I will review the numerous advances in the field of strongly magnetized neutron stars that will be possible thanks to the future availability of a large area instrument such as LOFT.

Gian Luca Israel

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Magnetar seismology and neutron star EOSs

Abstract In the latest few years the study of X/Gamma-ray flashes, long bursts, and giant flares from mangetars has opened new horizons in the field, through the study of the neutron star structure, magnetic field properties and the physical mechanism(s) responsible for their impulsive emission. The detection of QPOs during giant flares has impacted on the possibility of constraining the NS equation of state. However, the paucity of these events (so far) makes difficult to rely upon them for a systematic study. In this respect the less intense but more frequent intermediate flares (IFs) seems to be a robust alternative. The study of intermediate flares resulted an important tool for the study of a magnetically trapped fireball and on the different species of photons (E-mode and O-mode polarized ones) responsible for the timing and spectral properties of bursts. LOFT, with its capabilities, is expected to give a strong contribution in detecting both IFs and GFs and, therefore, in constraining the NS EOS.

Lorenzo Amati

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GRB investigation with the LOFT mission

Abstract Despite the huge advances occurred in the last years, the GRB phenomenon is still far to be fully understood. LOFT, possibly in combination with other GRB experiments flying at the same epoch, will give us useful and unique clues to some of these still open issues, through: a) measurements of the prompt emission down to 2 keV and arcmin localization with the Wide Field Monitor (WFM); b) measurements of the early afterglow emission with the Large Area Detector (LAD). In particular, the partly unprecedented characterization of the GRB X-ray prompt emission, joined with a source location accurate enough for optical follow-up, by the WFM will allow to investigate the properties of the circum-burst environment, thus getting further clues on the nature of the progenitors, to provide a more stringent tests for the emission mechanisms at play, to increase the detection rare of high-z GRBs w/r to previous missions, to shade light on the population of X-ray Flashes (XRFs) and sub-energetic events. While the GRB science with the WFM will come for free, provided the optimization of trigger logic and data modes and transmission to ground, the contribution from the LAD, consisting in the possible further characterization of the plateau phase of the early X-ray afterglow emission, will critically depend on the follow-up capabilities and policies of the mission.

Andrzej Zdziarski

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Contribution of jets to X-ray emission in black hole binaries

Abstract We study models of emission of jets, using constraints imposed by the flux at the turnover frequency, constraints from the observed X-rays, and upper limits at GeVs. They allow us to measure the magnetic field strength and the distance of the base from the center. The results are applied to Cyg X-1, in which a jet component dominating the hard X-ray emission has been claimed, and to GX 339-4. Cyg X-3 in the soft spectral state has been detected at ¿0.1 GeV, which spectral contribution presumably extends to hard X-rays. Its amplitude in hard X-rays can be constrained by the observed X-ray spectra and by an orbital modulation, measured by the Swift/BAT. The resulting constraint on the jet contribution can be then used to estimate the jet magnetic field and the jet power.

Day 3, morning, session 2: Observatory Science - cont. (chair: Margarita Hernanz)

Gloria Sala

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New views of the novae landscape from the LOFT

Abstract Novae in outburst are luminous X-ray sources, with emission spanning from the very soft X-rays (probing the residual nuclear burning on top of the white dwarf for some months or years) to hard-X or soft gamma rays (originated in the rapidly expanding ejecta or in the accretion stream). Fast oscillations detected in the soft X-rays during nova outbursts have never been investigated in the hard X-ray band due to the limited sensitivity of the present and past instruments in the high energy band. LOFT will provide the unique simultaneous ability to monitor the hard X-ray emission of novae with the WFM and, for the first time, study fast variability in the hard X-ray band with LAD, yielding precious information on the mass ejection/accretion processes. Among novae, the subclass of recurrent novae are thought to contain a massive white dwarf. This, in combination with a high burst frequency, make them good candidates to progenitors of Type Ia supernovae. The recurrent nova RS Oph showed a bright, prompt hard X-ray emission during the first 3 weeks of its 2006 outburst. The spectrum was dominated by thermal plasma emission and bright Fe line complex at 6-7 keV (as detected by RXTE). The WFM, with its large field of view, will allow to monitor the prompt hard X-ray emission of bright novae at the onset of their outbursts. Even for not exceptionally bright novae, the long term evolution of the hard X-ray emitting novae will be followed by the regular monitoring of the WFM. In exceptionally interesting cases like RS Oph, the bright prompt hard X-ray emission would be easily detected with the WFM and LAD observations could be scheduled for the following days. The unique LAD sensitivity and temporal resolution would provide unprecedented data on the expansion of the nova ejecta and the emission site of the plasma components

and the Fe lines. Simulations show that the early hard X-ray emission as detected for RS Oph with RXTE in 2006 provides enough count rate in the LAD to enable timing studies with timescales of a few seconds for the continuum, probing the emission sites for these SN Ia progenitor candidates. Simulations also show that time resolved spectroscopy could show time modulations within a 20% in time scales of tens of minutes for the Fe line complex at 6-7 keV even for more modest novae with hard X-ray flux $\sim 10^{-}12 ergcm^2 s^{-1}$ (as detected in post-outburst novae like V2491 Cyg 9-50 days after outburst, or V2487 Oph three years after outburst).

Imma Donnarumma

Blazar science with LOFT

Marat Gilfanov

Prospects of 6.4 keV line tomography with LOFT

Day 3, morning, session 2: Observatory Science - cont. (chair: Michiel Van der Klis)

Rob Fender

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Synergies with next generation radio telescopes

Abstract Most high energy astrophysical phenomena detected at X-rays have radio counterparts which can be used to provide information not possible in other ways, such as estimates of kinetic energy output and sub-arcsecond spatial structure. As a result combining the radio and X-ray bands greatly enhances our understanding of such phenomena. In this talk I will explore the synergies between LOFT and current and future radio telescopes, including LOFAR, ASKAP and MeerKAT en route to the SKA.

Roberto Mignani

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Synergies between LOFT and future optical facilities

Abstract In the next decade, new optical survey facilities will become operational, like the 8.4m LSST, which will scan large regions of the sky in deep, multi-epoch surveys. This will allow to search for variable sources on the day-to-years time scales and will provide a huge and unique observational data base to correlate with X-ray transients detected by the LOFT/WFM. On the other hand, the advent of the 39m E-ELT, coupled with instruments for high time resolution observations, will allow to search for variability on the ms time scales and will match the discovery potentials offered by the LOFT/LAD. In this contribution, I describe the future optical/infrared survey facilities and their synergy with the LOFT instruments.

Badri Krishnan

Detecting gravitational waves from pulsars: How LOFT could contribute?

Posters

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Constraining the equation of state of dense matter with X-ray burst oscillations

Abstract We show that detailed modeling of X-ray burst oscillations can be an extremely powerful probe of the neutron star structure (M, R), and thus the equation of state of ultra-dense matter. M and R are encoded in the shape of the oscillations resulting from the spin modulation of the thermonuclear burst flux from the neutron star. We have developed an hot spot model for X-ray burst oscillations, taking into account all relativistic effects affecting photon trajectories from the neutron star surface to the observer. We have simulated light curves assuming different M, R, hot spot geometry and emission pattern. We show that an improvement by at least a factor of 10 in count statistics (as achieved by LOFT) is required to detect the harmonic content of the signal, with the amplitude of the harmonics directly related to the asymmetry of the waveform. Using a Monte Carlo Markov Chain sampling method, we have then fitted the simulated light curves to evaluate the accuracy with which M and R could be recovered. We show that M and R can be constrained within less than 10% from one single burst, as required to discriminate between for the various equations of state of dense matter. This robust method let us have some good constraints on other parameters like the observer inclination or the colatitude of the spot center.

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A LOFT paper model for public outreach

Abstract We present our work on a paper model of the current iteration of the LOFT spacecraft for public outreach purposes. The design process, including simplification of the available CAD prototype, part design, texturing and finishing is described. The end result is presented in pictures. The finished model kit will be available to the community for download from http://www.sternwarte.uni-erlangen.de/loft/model .

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Dr

Abstract The behavior of the BHC 4U1630-472 during the 2006-2010 outbursts Capitanio F. and De Cesare G. 4U1630-472 is a recurrent X-ray transient classified as a BHC from its spectral and timing properties. The principal characteristic of this source is the presence of regular outbursts with a period that spans from 600 till about 700 days. We present here the analysis of the data collected by INTEGRAL and RXTE during three consecutive outbursts. In particular we focus on the differences and similarity of their spectral and timing properties. Moreover we speculate on the nature of the regular outbursts that the source have shown since its discovery in 1969.

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What can NuSTAR do for X-ray bursts?

Abstract Unstable thermonuclear burning on the surface of accreting neutron stars is commonly observed as type I X-ray bursts. The flux released during some strong bursts can temporarily exceed the Eddington limit, driving the neutron star photosphere to such large radii that heavy-element ashes of nuclear burning are ejected in the burst expansion wind. We have investigated the possibility of observing with NuSTAR some X-ray bursters selected for their high burst rate and trend to exhibit so-called superexpansion bursts.

Our main ambition is to detect the photoionization edges associated with the ejected nuclear ashes, and identify the corresponding heavy elements. A positive identification of such edges would probe the nuclear burning processes, and provide a measure of the expansion wind velocity as well as the gravitational redshift from the neutron star. Moreover, we expect that the high sensitivity of NuSTAR in hard X-rays will make it possible to study the behavior of the accretion emission during the bursts, which is an important parameter to constrain the properties of the X-ray burst emission and thermonuclear burning.

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Resolving the turbulent accretion of Cir X-1 with LOFT

Abstract One of the most enigmatic X-ray binaries of the Galaxy, Cir X-1 displays a wide range of physical phenomena due to its anomalous geometry, that is in-between the classical low-mass and the Be X-ray systems. I will review the latest results in the X-ray study of this source, focusing on its recent activity as a bursting source, presence of warm absorbers, and outbursting behavior. I will present the unique capabilities offered by LOFT to disentangle the fast (seconds to hours) spectral changes caused by dipping, with local neutral and partially ionized absorptions.

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Modulation of magnetar emission by Alfven oscillations of the neutron star

Abstract The quasi-periodic oscillations (QPOs) observed in giant outbursts of soft-gamma ray repeaters (SGRs) are commonly interpreted as torsional oscillations of the highly magnetized neutron star (magnetar), which is assumed to be the source of the gamma-ray emission. We extend a study concerned with the analysis of the magneto-elastic oscillations inside the magnetar by allowing the perturbations to extend into the magnetosphere. The latter is assumed to behave as force-free, i.e. we neglect all inertia and pressure terms but allow for magnetospheric currents. In our approach the magnetosphere is evolved quasi stationary as a sequence of force-free equilibrium models, each being completely defined by the magnetic

field given at the magnetar surface. This boundary magnetic field is obtained from the simulations of the oscillations of the magnetar interior. The currents maintaining the magnetospheric field con

figuration are giving rise to a possible mechanism of modulating the emission during the giant flare and hence may explain the observed QPOs in the tail of a giant flare. The mechanism analyzed in this work is that the charge carriers may provide a substantial optical depth due to resonant cyclotron scattering.

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Thermonuclear burst spectroscopy using LOFT

Abstract Thermonuclear (type-I) X-ray bursts, caused by unstable ignition of accreted fuel on the surface of neutron stars, provide insights in to nuclear burning processes as well as serving as probes of the interior conditions of these objects. Understanding the shape of the emergent spectrum during bursts is critical to both of these objectives. While the X-ray spectrum measured with various instruments is generally consistent with a blackbody, at least two classes of exceptions are presently known. First, the presence of significant residuals in extreme radius-expansion ('superexpansion') bursts suggest the presence of absorption edges, likely arising from nuclear burning ashes mixed into the radiation-driven ejecta powered by the burst flux. Such features have been predicted theoretically, and can in principle provide information on the neutron star compactness. However, high-quality spectra have proved difficult to obtain, principally because such bursts are infrequent and unpredictable. Such features have not been detected in weaker, more typical radius-expansion bursts. Second, in a large sample of low resolution spectra observed by RXTE, we find a significant fraction that feature a hard excess compared to a blackbody. This excess suggests either that the persistent flux level varies during bursts, and/or a more complex underlying shape for the emergent spectrum. The high sensitivity and good spectral resolution goals for LOFT will likely provide significant new insights into both these areas. Moderate exposure to superexpansion burst sources over the mission lifetime will offer a high probability of detection, allowing confirmation of the nature and properties of the putative absorption features. Observations of more typical radius-expansion bursts, which are weaker but much more frequent, will permit searches for features in those bursts. Similarly, higher signal-to-noise burst spectra will provide a more stringent test of the blackbody model, and likely reveal in detail the nature of the high-energy excess.

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GRB investigation with the LOFT mission

Abstract The Large Observatory for x-ray Timing (LOFT) is a medium class mission currently in Assessment Phase as one of four candidates for the ESA M3 selection. Two instruments compose the LOFT payload: the Large Area Detector (LAD), sensitive between 2 and 50 keV with a peak effective area of about 10 m^2 and an energy resolution of about 200 eV, and the Wide Field Monitor (WFM), a coded aperture instrument covering more than 50 % of the Sky in the 2 - 50 keV energy band with a sensitivity of 1 Crab in 1 s integration, an energy resolution of about 500 eV and a point source location accuracy of 1 arcmin. The WFM is equipped with onboard trigger and imaging system, together with fast-link transmission of the position of fast transients. The scientific performances of the WFM are particularly well suited for the investigation of some of the most relevant open issues in the study of Gamma Ray Bursts (GRBs): the models for the physics of the prompt emission, the existence and properties of spectral absorption features by circum-burst material, the population and properties of X-Ray Flashes, the detection and rate of high-z GRBs. We discuss how the combination of the measurements by the LOFT/WFM with those of other GRB experiments possibly flying at that epoch, together with the optimizations of data acquisition / transmission will significantly improve our knowledge in this important field of modern Astrophysics.

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Swift XRT Timing Observations of the Black-Hole Binary SWIFTJ1753.5-0127: Disk-Diluted Fluctuations in the Outburst Peak

Abstract X-ray variability studies of Black hole binaries have been carried out with RXTE for over a decade. Due to the limitation of a lower energy bound at 2 keV, the behavior of variability in the soft band remains mostly unexplored. Swift XRT, having an energy range 0.3 - 10 keV, provides an opportunity to explore this. We study the outburst of the black hole binary SWIFT J1753.5 - 012, which has been speculated to have a cool disk (emitting in soft band). From our analysis we are able to present the first measurements of the soft band variability in the peak of the outburst and find it to be less variable than the hard band, especially at high frequencies, opposite to what is seen at low intensity. Both results can be explained within the framework of a simple two emission-region model where the hot flow is more variable in the peak of the outburst and the disk is more variable at low intensities.

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Fitting X-ray Pulse Profiles of Millisecond Pulsars: Comparison of

Single and Multi-epoch Pulse Shape Fits

Abstract Millisecond (ms) X-ray pulsars are rapidly rotating neutron stars where general relativity plays a strong role in the propagation of light from the neutron star to observer. As a result, the observed X-ray pulse shape carries information on the mass, radius and surface shape of the neutron star. Thus, comparison of model calculations of pulse shapes with observations can usefully constrain neutron star properties. We have developed a numerical model which includes light bending, time-delays and Doppler effects for photons. It also accounts for oblateness of the neutron star, caused by the rapid rotation. Scattered light from the surface of the accretion disk has recently been included in the model. Current work is focused on using multiple observations of pulse shapes from the same ms pulsar, with the aim of significantly improving the constraints on the neutron star properties. Here, we compare results using multi-epoch observations of SAX J1808-3658, for which the pulse shapes vary significantly. This example is used to shed light on how effectively multi-epoch pulse shape observations can assist in the goal of deriving accurate neutron star parameters, such as mass and radius.

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X-ray Pulsars in the Small Magellanic Cloud

Abstract The advantages of studying the compact object content of the Magellanic Clouds are well known: it has a relatively small angular size, is at a reasonably close and known distance, and is located at a high Galactic latitude, with little obscuration by the interstellar medium of the Galaxy. In addition, there is evidence for recent star formation in the SMC over the last few tens of millions of years, which creates an environment in which X-ray pulsars are expected to be plentiful. This expectation is borne out by discoveries over the years of 50 X-ray pulsars in the SMC based on observations from the ASCA , ROSAT , RXTE , Chandra, and XMM-Newton X-ray missions. To explore the nature and evolution of these kinds of systems collecting a large sample of pulsars is as important as the monitoring of single systems over longer periods of time. With LOFT's promise of much improved sensitivity, the expectation is for a large increase in the number of detected accreting pulsars. We will discuss potential contributions that LOFT will make in studies of SMC pulsar population.

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Spectra and fast multi-wavelength variability of compact jets powered by internal shocks

Abstract The emission of steady compact jets observed in the hard spectral state of X-ray binaries is likely to be powered by internal shocks caused by fluctuations of the outflow velocity. The dynamics of the internal shocks and the resulting spectral energy distribution (SED) of the jet is then very sensitive to the shape of the Power Spectral Density (PSD) of the fluctuations of the jet Lorentz factor. I used both simulations and semi-analytical methods to investigate this dependence. It turns out that Lorentz factor fluctuations injected at the base of the jet with a flicker noise power spectrum (i.e. P(f) 1/f) naturally produce the canonical flat SED observed from radio to IR band in X-ray binary systems in the hard state. This model also predicts a strong, wavelength dependent, variability that resembles the observed one. In particular, strong sub-second variability is predicted in the infrared and optical bands. The complex timing correlations observed between the IR/optical light curves and the X-rays can then be used to probe the accretion/ejection connection on short time-scales. Preliminary results suggest that the X-ray count rate is anti-correlated with the jet Lorentz factor.

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Observations of Isolated Neutron Stars and Pulsar Wind Nebulae with LOFT

Abstract The unprecedented collecting power of the LAD on LOFT, together with its time and spectral resolution will make it possible to carry out researches on isolated neutrons stars (INSs), which exceed the limit of current satellite/instrument capabilities. LAD observations will be key to study the properties of the INS magnetospheres and the radiation emission processes in different magnetic field regimes, such as in rotation-powered pulsars and magnetars , and track sudden changes in the magnetosphere properties related to impulsive events. LAD observations will also pave the way to the discovery of several, new X-ray pulsars both in the Galaxy and in the Magellanic Clouds, many of which associated with unidentified gamma-ray sources detected by Fermi, or embedded in supernova remnants and candidate pulsar-wind nebulae (PWN) detected by Chandra. The WFM will complement the LAD work through its continuous monitoring for transient X-ray sources, which will lead to the discovery of several new magnetars. In this talk, we summarise the perspectives for INS observations as part of the LOFT Observatory Science program

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Fast (LAD) and slow (WFM) timing of ultraluminous X-ray sources with LOFT

Abstract Ultraluminous X-ray sources (ULXs) are point-like, off-nuclear, extragalactic X-ray sources with X-ray (0.3-10.0 keV) luminosities in the range of $10^{3}9 - 10^{4}1$ ergs/sec. They remain mysterious in the sense that their high luminosities imply either sub-Eddington accretion onto intermediate-mass black holes (a few 100-1000 solar masses) or super-Eddington accretion onto stellar-mass black holes (3-30 solar masses). Although ULXs are not one of the primary science goals of the LOFT mission, we show how the Large Area Detector (LAD) and the Wide Field Monitor (WFM) can be used to reveal the accretion nature of these systems. Contribution from the LAD: The broadband variability of galactic X-ray binaries can be characterized by the presence of a continuum (some sort of a broken power law) and low frequency quasi-periodic oscillations (LFQPOs: 1-10 Hz). If ULXs are indeed intermediate-mass black holes then they should, in principle, exhibit qualitatively similar broadband variability. However, one would expect the frequencies to scale appropriately with the mass of the black hole. There are now only three ULXs where such behavior has been detected. Given that ULXs are distant and hence not as bright as their galactic counterparts, i.e., galactic X-ray binaries, timing studies of ULXs have been difficult. The Large Area Detector onboard LOFT with an effective area of 8 m^2 will be a perfect instrument to observe ULXs with a significantly high count rate compared to the present detectors. Contribution from the WFM: There are currently two ULXs where long-term X-ray modulations have been detected: M82 with a 62 day X-ray period and NGC 5408 X-1 with a 115 & 243 day periods. It is not clear whether these detected periods represent the orbital motion of the binary or a super-orbital period (e.g., a precessing disk). Further monitoring is necessary to break the degeneracy between different models. The WFM will be an ideal instrument to monitor ULXs and hence detect any long-term X-ray periods. Furthermore, many accreting galactic X-ray binaries are transients and show spectral state transitions. This phenomenon has NOT been clearly observed in ULXs. Regular monitoring with the WFM will be suitable for tracking the spectral states of these sources. In summary, LOFT will be able to reveal QPOs, long-term X-ray periods and spectral state transitions from ULXs.

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Constraining the mass and moment of inertia of neutron stars from quasi-periodic oscillations in X-ray binaries.

Abstract Neutron stars are the densest objects known in the Universe. Being the final product of stellar evolution, their internal composition and structure is rather poorly constrained by measurements. It is the purpose of this paper to put some constrains on the mass and moment of inertia of neutron stars based on the interpretation of kHz quasi-periodic oscillations observed in low mass X-ray binaries. We use observations of high-frequency quasi-periodic observations (HF-QPOs) in low mass X-ray binaries (LMXBs) to look for the average mass and moment of inertia of neutron stars. This is done by applying our parametric resonance model to discriminate between slow and fast rotators. We fit our model to data from ten LMXBs for which HF-QPOs have been seen and the spin of the enclosed accreting neutron star is known. For a simplified analysis we assume that all neutron stars possess the same properties (same mass M_* and same moment of inertia I_*). We find an average mass $M_* \approx 2.0 - 2.2\, M_\odot$. The corresponding average moment of inertia is then $I_* \approx 1 - 3 \times 10^{38}$ kg m$^2 \approx 0.5 - 1.5\,(10\ \text{km})^2\, M_\odot$ which equals to dimensionless spin parameter $\tilde{a} \approx 0.05 - 0.15$ for slow rotators (neutron stars with a spin frequency roughly about 300 Hz) respectively $\tilde{a} \approx 0.1 - 0.3$ for fast rotators (neutron stars with the spin frequency roughly about 600 Hz).

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Poster Title: Subarcsecond location of IGR J17480-2446 with Rossi XTE:possible applications for the LOFT X-ray mission

Abstract The X-ray astronomical satellite Rossi XTE in 2010, during the observation of the newly discovered AXP IGR J17480-2446, detected a serendipitous lunar occultation of the source. Taking advantage from the present knowledge of lunar topography and Earth, Moon, and spacecraft ephemeris, we determined, using a non-imaging X-ray observatory, the position of an X-ray source with an unprecedented 40 mas accuracy.

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Broad band X-ray spectra from compact objects seen by LOFT

Abstract We present continuum and line X-ray spectra from different classes of astrophysical objects seen by LOFT detectors. Our modeled spectra are computed using advanced radiative transfer code ATM24 through the stratified atmospheres in radiative and hydrostatic equilibrium. An ionization balance with heavy elements and full Compton scattering are self consistently computed. We

take into account external irradiation by hard X-rays if it is needed. Outgoing spectra show resonance and fluorescent iron lines, and reflection bump due to irradiation. We show how LOFT satellite will be able to detect radiation from hot neutron star atmospheres, and from the accretion disks both in X-ray binaries, and AGN.

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KILOHERTZ QUASI-PERIODIC OSCILLATIONS AND BROAD IRON EMIS- SION LINES AS A PROBE OF STRONG-FIELD GRAVITY.

Abstract Kilohertz quasi-periodic oscillations (kHz QPOs) and broad iron emission lines are thought to be produced at the inner edge of an accretion disk around neutron stars in low mass X-ray binary systems (LMXBs). The frequency of kHz QPOs and the width of iron lines strongly suggest that these phenomena take place just few kilometers above the surface of the neutron star and hence they should probe the strong gravitational field around these stars. Both QPO variability and iron line hold the promise of searching for signatures of strong-field general relativity, e.g. the ISCO or Lense-Thirring precession. Here I present results of he kHz QPOs and the broad iron line in the persistent neutron star LMXB 4U 1636-53. For this source we find a complex relation between kHz QPOs and properties of the iron line, which is difficult to explain if both phenomena reflect properties of the same region in the accretion disk.

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The LAD Event Simulator

Abstract We present a Monte Carlo simulation software tool for the LOFT LAD. The software produces a sample of photons based on a given source specification and processes these photons through the instrument model consisting of a collimator and a detector component. The source specification is based on the so-called SIMPUT file format, which provides powerful means to describe various kinds of astronomical objects in a mission-independent way. The simulation toolkit provides realistic estimates for observations of particular sources and enables the investigation of instrument-specific effects such as the dead time properties of the detector. The event files produced by the detector model can be used as a substitute for real observation data for software development and testing. For easy access we provide a web interface to the simulation software

(http://cetus.sternwarte.uni-erlangen.de/ loftsim/).

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The relativistic iron line produced by a viscously spreading ring near a massive black hole

Abstract We consider a spectral line formed by an X-ray illumination of an accretion ring near a supermassive rotating black hole. The ring is assumed to be gradually dissolved by viscous processes. We consider a simple model spectrum consisting of a power-law primary continuum and K-alpha reflection line of iron, and we show how the observed spectral profile changes in time. Model parameters are view angle of the observer, spin of the black hole, the initial radius of the ring, and its viscosity parameter.

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Using X-ray Light Curves to Constrain the Neutron Star Equation of State

Abstract The equation of state for ultra-dense matter has puzzled astrophysicists for decades. This is because the conditions of ultra-dense matter, such as those found in neutron stars (NSs), are not terrestrially replicable. X-ray light curves from low-mass X-ray binary (LMXB) systems, with NS primaries, have proven to be useful tools in the study of the NS equation of state. Theory predicts that the X-ray light curve resulting from a Type I X-ray burst at a hotspot on the surface of an accreting millisecond X-ray pulsar can be used to determine the characteristics the hotspot, and place constraints on the NS. However, NSs and their hotspots have a large number of parameters both from the physical system and measurement procedures, so it is difficult to extrapolate the mass and radius of a NS precisely. Since the precision of a light curve depends heavily on timing, LOFT's predicted timing capabilities will allow for better light curve measurements and therefore more precise determination of the parameter values. In this talk, we discuss the development a spherical NS model that, providing initial conditions, yields an X-ray light curve comparable to that which would be measured by LOFT. This code will provide us with an opportunity to disentangle the effects of various aspects of the NS and hotspot on the outputted light curve, showing which will have the greatest impact on the observable. By combining our code with the fantastic timing resolution of

LOFT, we will be able to better constrain the mass and radius of NSs.

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Constraining acceleration and emission processes in blazars with X-ray data above 10 keV: a study of the LOFT/LAD impact.

Abstract The precise knowledge of the X-ray spectral shapes allows to find interesting fingerprints of both acceleration and radiative processes. In particular the intrinsic spectral curvature at the peak of the synchrotron SED, has been successfully used as a signature of stochastic acceleration processes. Self consistent stochastic models are able to reproduce X-ray spectral trends, both on short and long time scales (up to years), for BL Lac objects, with the peak energy of the synchrotron emission above the UV frequencies. Due to the poor statistics in the band above 10 keV, the present data are not able to fully constrain this scenario. We show that thanks to the unprecedented statistics of the LOFT/LAD instrument, we can distinguish spectra described by a pure log-parabolic shape, hinting for an acceleration dominated scenario, from models showing even mild exponential cut-off, that hint for cooling dominance, or a transition of the system toward the equilibrium. These observational features will allow to constrain both the acceleration time scales, and the magnetic fields, with an unprecedented precision. The potentiality of these data, will be even more effective due to possible joint observational campaigns with the CTA.

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Probing the nature of the weak emission lines in the optical spectra of BL Lacs

Abstract Blazars are the rarest and most extreme type of Active Galactic Nuclei (AGN) known, characterized by strong and highly variable, non-thermal emission by a jet of relativistic particles, spanning the whole electromagnetic spectrum, from radio wavelengths to the most energetic gamma-rays up to TeV energies. Surely their rapid variability makes them really interesting targets for the LOFT mission. Namely, blazars come in two main subclasses, whose major difference is in their optical properties, with Flat Spectrum Radio Quasars (FSRQs) showing strong, broad emission lines in their optical spectrum, and BL Lacs, on the contrary, with typical featureless spectra with no or at most weak absorption lines (host galaxy features), even though a bunch of them have weak, transient emission lines. The nature of the transient weak emission lines in BL

Lacs is still under debate, since they could be normal lines, simply diluted by the high jet non-thermal emission (as in the FSRQs), or they could be instead the signature of an intermittent formation of the Broad Line Region (BLR), which can give rise to External Compton (EC) emission. In such a case, the lines could be connected with an high state in EC, that can be probed with LOFT data (and also in gamma-rays). This latter scenario can also explain the similarities between FSRQs and a subclass of BL Lacs. Here we present results from simulations of simultaneous observations of LOFT instruments and the X-SHOOTER spectrograph at VLT to investigate the nature of these lines in BL Lacs. At present, it is not known the nature of the temporal correlation that can potentially occur between the intensity of the lines and a high energy flare. Thus, we studied two major cases: i) a continous monitoring of a small sample of good candidates and ii) a random sampling of a wider sample of BL Lacs. In particular, we calculated in both cases the chance probability to detect the lines during an high energy flare and we show the feasibility to put constraints on the different scenarios.

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RWI as a model for HFQPOs in microquasars

Abstract There have been a long string of efforts to understand the source of the variability observed in microquasars but no model has yet gained wide acceptance, especially concerning the elusive High-Frequency Quasi-Periodic Oscillation (HFQPO). Here we will present the model based on having the Rossby Wave Instability (RWI) active in the disk. We will show how it can answer the existing observational constraint and also the relatively small impact of the black hole spin.

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SIMPUT - A File Format for Simulation Input (Poster)

Abstract With SIMPUT we present a standard format for source input files to be used in simulations of astronomical observations. Each source file contains a catalog with one or multiple sources which are described by specific properties such as position, brightness, energy spectrum, as well as optional characteristics such as time variability, polarization and spatial extent. The SIMPUT file format defines a common basis to exchange data between different software packages and scientific groups. It was developed in particular for the

simulation of X-ray telescopes and is already used in several projects such as, e.g., eROSITA. However, SIMPUT can also be utilized in different wavelength domains.

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Monitoring the Crab Nebula with LOFT

Abstract From 2008-2010, the Crab Nebula was found to decline by 7% in the 15-50 keV band, consistently in Fermi GBM, INTEGRAL IBIS, SPI, and JEMX, RXTE PCA, and Swift BAT. From 2001-2010, the 15-50 keV flux from the Crab Nebula typically varied by about 3.5% per year. Analysis of RXTE PCA data suggests possible spectral variations correlated with the flux variations. I will present estimates of the LOFT sensitivity to these variations. Prior to 2001 and since 2010, the observed flux variations have been much smaller. Monitoring the Crab with the LOFT WFM and LAD will provide precise measurements of flux variations in the Crab Nebula if it undergoes a similarly active episode.