ABSTRACT BOOK

XMM-NEWTON: THE NEXT DECADE

An XMM-Newton Science Operations Centre Workshop
4 - 6 June 2007 at
ESA's European Space Astronomy Centre, Madrid, Spain

Edited by

MATTHIAS EHLE

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Session A: Stars, Star forming Regions & the Solar System

Star-disk interactions in young accreting stars in outburst (Poster)

Marc Audard
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M. Guedel, S. Skinner, K.R. Briggs, G. Stringfellow, et al.

The X-ray emission of young accreting stars during outbursts can be strongly influenced by the increase in mass accretion rate. The X-ray flux increases simultaneously with the optical and near-infrared fluxes. The time evolution of the X-ray spectrum may differ among stars, though: while V1647 Ori kept a hard, hot spectrum, V1118 Ori's spectrum softened and slowly returned to a harder state, but its X-ray flux decreased below the pre-outburst level. The closing-in of the accretion disk during the outburst may have disrupted the stellar coronal magnetosphere and have produced a new magnetic configuration. I propose to present X-ray observations of outbursting stars that provide direct evidence of star-disk interactions in young accreting stars.

Stellar coronae in saturated and supersaturated late-type stars (Poster)

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We present an analysis on the coronal properties of fast rotating late-type stars. We will show illuminating glimpses of the fundamental differences in magnetic dynamos and activity between these stars and those in "slower" rotators (log(Rossby number)>-1.5). We compare our results with those in the literature for such slower rotators and find numerous contrasting features and trends:

1. the relative emission at high-temperature rises inversely with the Rossby number until the boundary of the saturated/supersaturated regimes, and then the trend reverses for supersaturated stars;

2. the absolute Fe coronal abundances decrease with Rossby number; there are also suggestions of a possible mass dependency for the chemical fractionation (such as gravitational settling of the heavier Fe ions);

3. the O/Fe ratio increases as stars approach supersaturation, and then appears to decrease once supersaturation is achieved;

4. binary systems with subgiant components generally show smaller O/Fe values compared to dwarfs; and

5. the Ne/Fe ratio shows a similar trend with Rossby number as that of O/Fe.

We discuss the coronal thermal structure and chemical composition of satutared-supersaturated stars in the context of currently favored ideas of coronal stripping and dynamo saturation in rapidly rotating stars.

X-Ray Spectroscopy of Young Stars (Solicited Talk)

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X-ray spectroscopy provides the means to study the physics of coronae, magnetospheres, and accretion streams of young stars. I will summarize results on thermal structure, plasma composition, electron densities and proposed models for the X-ray sources. There are numerous issues that are under debate and will require significantly deeper observations. I will discuss these problems together with requirements for future observations addressing them.

Doing physics in star-forming regions: high-speed shocks and magnetic fields (Review Talk)

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Star-forming regions have been known to emit X-rays for over 30 years. As sensitivity, spatial and spectral resolution of X-ray satellites improved, along with the advent of new ground-based facilities, our view of the physics of young stars has dramatically evolved. We now have at our disposal impressive statistics over thousands of young stars of all types, as well as large-scale spatial surveys of major star-forming regions.

Albeit on sometimes very different time and spatial scales, two main physical processes, either separate or combined, are at work to explain the X-ray emission from star-forming regions: (i) magnetic loop reconnection and plasma confinement; (ii) high-speed shocks, from magnetically channeled accretion and mass-loss, from jets hitting protostellar envelopes or molecular clouds, from colliding stellar winds, or from supernova remnants. Prospects for doing new physics in young stars and star-forming regions with XMM will be discussed.

The sustainability of life in X-ray irradiated planetary atmospheres (Contributed Talk)

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C. Eiroa, M. Fridlund, J. Sanz-Forcada et al.

The main objective of the ESA Darwin mission is to search for signs of habitable planets orbiting nearby stars. The conditions under which life may develop in the universe are expected to include a planetary atmosphere stable for gigayears under favorable thermal conditions. Another vital consideration concerns the high-energy environment, including the effects of possible X-ray flares and coronal mass ejections which can lead to significant disturbances in atmospheres for ionization on macroscopic planetary scales and mutations on microscopic genetic scales. Thus the coronal X-ray properties of the few hundred F, G, K and M stars within a few tens of parsecs of the sun that comprise the Darwin samples are of the utmost importance: a quiet high-energy environment is a necessary condition for life to develop. The X-ray coverage of these stars obtained so far is poor, relying almost without exception on the ROSAT All-Sky Survey. There have been, for example, XMM-Newton observations of only 4 of the complete Darwin sample of 79 F, G and K stars within 15pc: in addition to the active RS CVn HR1099, that has been observed on many occasions for calibration purposes, there are only single exposures of Procyon, beta Vir and tau Boo. There is a need to define both the quiescent and flaring X-ray properties of nearby stars on planets around which life might form: the quiescent flux is an indicator of stellar age; while flaring activity can push planetary atmosphere beyond the physical limits in which life may form. Observations of this type could entail a change in the philosophy underlying the way observing time is allocated.

AB Dor: the best X-ray spectrum (Poster)

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After 6 years of observations as a calibration target, the active star AB Dor has accumulated almost 900 ks of XMM-Newton/RGS observations. In this work we analyze the merged spectrum of all the RGS observations of AB Dor, the best spectrum ever recorded in X-rays. The long term variations in the X-ray flux of AB Dor are also discussed.

XMM-Newton probes massive-star feedback and the evolution of star clusters (Contributed Talk)

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XMM-Newton observations elucidate the entire life cycle of massive stars – from ultra-compact HII regions to supernova remnants – and the effects that those massive stars have on their surroundings. X-ray studies of star-forming regions trace massive stars themselves, the accompanying lower-mass cluster population, new star formation that may be triggered by the massive cluster, interactions of massive-star winds with each other and with the surrounding medium, and the fate of massive stars that die as cavity supernovae inside the wind-blown bubble they created. We briefly review already accumulated X-ray data which uncover the massive stars as key feedback agents in the star-formation process. We propose that the X-ray observations can be used to establish observationally the causal connection between a massive star cluster and on-going star formation. Two feedback agents, photoionization and stellar winds, can be distinguished by means of X-ray observations. The X-ray-dating based on the magnetic and wind activity of young stars can be used to establish the evolutionary links in the star-formation regions and to study the early history of star clusters.

X-ray spectroscopy of early-type stars: the present and the future (Review Talk)

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et al.

XMM-Newton and *Chandra* have boosted our knowledge about the X-ray emission of early-type stars (spectral types OB and WR). However, there are still a number of open questions that need to be addressed in order to fully understand the X-ray spectra of these objects. Many of these issues require high-resolution spectroscopy or monitoring of a significant sample of massive stars. Given the moderate X-ray brightness of these targets, rather long exposure times are needed to achieve these goals. In this presentation, I review our current knowledge in this field and present some hot topics that could ideally be addressed with *XMM-Newton* over the next decade.

Cool stars (Review Talk)

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I will try to review and summarize the central results in cool star research obtained with XMM-Newton and identify open issues and research opportunities for XMM-Newton in the next decade.

Results and Perspectives of Young Stars long look programs (Solicited Talk)

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Both Chandra and XMM-Newton have performed long (> 250 ksec) look observations, devoted to the study of X-ray emission from Young Stellar Objects (YSO) in the Galaxy. These program are allowing to address issues related to the physical origin of X-ray emission in YSOs, to its interplay with circumstellar disks, etc. as well as to investigate, in connection with optical/IR observations, some of the properties of star formation process in different environments.

I will present a few of the results so far obtained and I will give a perspective view of what can be done with XMM-Newton in the next coming years.

X-Ray Spectroscopy and Photometry of the long-period polar AI Tri with XMM-Newton (Poster)

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Based on XMM-Newton observations, covering for the first time uninterruptedly a complete binary orbital period, we present our spectroscopic and photometric analysis of the long-period magnetic cataclysmic variable AI Tri. Over about 70% of the binary orbit are dominated by soft X-ray emission from the heated surface of the white dwarf with a highly variable flaring light curve. The associated spectral component can be described in good approximation by a mildly absorbed blackbody component with $kT_{\rm bb} = 35.8^{+1.5}_{-1.5}\,{\rm eV}$ and $N_{\rm H} = 3.66^{+0.43}_{-0.47} \cdot 10^{20}\,{\rm cm}^{-2}$. In addition, weaker hard X-ray emission is visible nearly all the time. The hard spectral component, originating from the diffuse hot plasma in the post-shock accretion column, is modeled by a MEKAL model with a mean temperature of $kT_{\rm Mekal} = 13.5^{+5.4}_{-2.5}\,{\rm keV}$ and three times solar abundance. The ultraviolet light curve obtained with OM has a similar shape but a higher amplitude than the optical light curves during high state of accretion. In contrast to that, the EPIC/PN X-ray light curve shows a broad dip in the soft X-ray regime during the bright phase, which can be interpreted as self-eclipse of the accretion region. Phase-resolved spectral modeling supports the picture of one-pole accretion and self-eclipse.

Chapter 3

Session B: Compact Objects

A deep view into the black holes high energy emission (Poster)

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Deep ToO observations with INTEGRAL (3-1 000 keV) and XMM (0.5-10 keV) of the known black hole transients in our galaxy during their outbursts are key in the understanding of the continuum underlaying the X-ray and gamma-ray emission of these objects.

XMM-Newton observations simultaneous with INTEGRAL provide the broad energy coverage necessary in order to determine both the properties of the accretion flow of the medium (< 10 keV), namely Fe Kα relativistic emission line plus the absorption lines and edges and the behaviour of the scattered light.

The photons coming from the inner region of the accretion disk interact with the existing corona (i.e. neutral plasma consisted of electrons and protons) providing the high energy emission seen with INTEGRAL ($E > 20$ keV). This high energy emission can serves us to disentangle the nature of the particle distribution of these plasmas (coronae), which can be both thermal and non-thermal. Also noticeable is the presence of reflection features from a high energy source which could be variable (jet?).

With GRO J1655-40 (Caballero-García et al., 2007, subm.) we learnt about the changing of the accretion flow properties and the significant presence of a non-thermal distribution of electrons even in the classical low-hard state of black hole systems, being an unexpected issue as infrerred from the previous studies. With GX 339-4 we have noticed that the high energy emission, and may be the properties of the accretion flow, is highly variable (Caballero-García et al. 2007, in prep.). Undoubtedly XMM and INTEGRAL observatories provide us a unique insight into the understanding of the physical mechanisms that power the X-rays and gamma-rays already seen in black hole transients.

"Resolving" Neutron Stars Physics and Geometry (Review Talk)

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The unprecedented harvest of X-ray photons detected from a score of isolated neutron stars has made it possible to glimpse at their emission mechanisms as well as at their emission geometry. Rotating hot spot(s), superimposed to the global thermal emission from the neutron star surface, are seen from several objects, allowing to probe the stars' external heating sources.

Non-thermal emission is also seen to vary as the stars rotate. Moreover, absorption features have been detected in the spectra of several objects, allowing to probe (tentatively) the stars' magnetic fields. Spectacular tails, trailing the stars' supersonic motion, trace the boundaries of the relativist winds streaming from the star's magnetosphere.

Apart from classical radio pulsar and certified radio-quiet neutron stars, XMM-Newton has devoted significant observation time to the enigmatic central compact objects, presumably isolated neutron stars shining at the center of their SNRs. Far from showing a unifying behaviour, XMM-Newton data have unveiled a surprising diversity.

X-ray properties of magnetic accreting white dwarfs (Poster)

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Among Cataclysmic Variables (CVs) the magnetic systems represent the brightest X-ray sources. Their X-ray emission is generally characterized by a hard optically thin component extending up to 90 keV and soft optically thick component due to reprocessing of hard X-rays and cyclotron emission at the polar regions of the accreting white dwarf. The relative proportion of soft-to-hard X-ray emission strongly depends on the magnetic field strength of the compact object.

While the high magnetic field ($B > 20$ MG) systems (the Polars) are well known to possess a relatively strong soft X-ray component, this component was known to be present in only 3 systems of the group of the Intermediate Polars, which are believed to possess low-field accreting white dwarf ($B < 10-20$ MG). XMM-Newton observations has instead changed this view revealing a soft X-ray component in an increasing number of systems of this group. The evolutionary link between the two classes is still debated as the Intemediate Polars might be the progenitors of the synchronous Polar systems or they might represent the low-field tail of the magnetic field distribution of magnetic CVs. The study of their X-ray properties is essential to determine the energy budget not only to link their evolutionary status but also to characterize this class of magnetic CVs which only recently have been identified as an important population of hard X-ray sources in our Galaxy from the recent hard X-ray surveys performed by Integral and Swift satellites.

The Modified Timing Mode - observing bright sources with XMM-Newton (Contributed Talk)

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Studying bright sources with the maximum possible time resolution in combination with a satisfying signal to noise ratio using the standard modes of the XMM-Newton EPIC-pn is not always trivial due to telemetry restrictions or pile-up limitations. Our group therefore suggested an Modified Timing Mode which allows to observe bright sources like Cygnus X-1 without losing as much signal to noise ratio as the burst mode while retaining full time resolution. To achieve this goal, the two MOS cameras have to be switched off and the low energy threshold of the pn camera has to be increased to $\sim 2.8\,\mathrm{keV}$ to be able to transmit all events. This observing mode was used in November and December 2004 to observe the black hole binary Cygnus X-1 simultaneously with INTEGRAL and RXTE for four times. In this talk we present results of the analysis of the relativistic Fe Kα line and its variability based on our calibration of the modified timing mode. We also discuss the implications of the broad band $2.5\,\mathrm{keV}$ - $1\,\mathrm{MeV}$ spectrum from XMM, RXTE, and INTEGRAL measurements and give an overview of the capabilities the Modified Timing Mode might provide for future observations with XMM-Newton.

X-ray pulsar radiation from hot polar caps heated by back-flow bombardment (Poster)

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G.I. Melikidze

We consider the problem of the thermal X-ray radiation from the hot polar cap of radio pulsars showing evidence of ExB subpulse drift in radio band. Using the partially screened gap (PSG) model of the inner acceleration region we derived a simple relationship between the drift rate of subpulses observed in a radio-band and the thermal X-ray luminosity from polar caps heated by the spark-associated back-flow particle bombardment. This relationship reflects the fact that both the drift rate and the polar cap heating rate are determined by the same value of the gap electric field. The theoretical formula can be tested for pulsars in which the so-called carousel rotation time P_4 of the ExB plasma drift (time interval after which sparks complete one full revolution around the polar cap), and the thermal X-ray bolometric luminosity L_x from the hot polar cap are known. There are currently four pulsars in which both quantities P_4 and L_x are measured or at least estimated: PSRs B0943+10, B1133+16, B0656+14 and B0628-28. They all seem to fully confirm the predictions of the PSG model. Other available models of the inner acceleration region fail to explain the observed relationship between radio and the XMM-Newton data. The pure vacuum gap model predicts too high L_x and too low P_4, while the space charge limited model predicts too low L_x and the origin of the subpulse drift has no natural explanation. The systematic XMM-Newton observations of radio pulsars for which the value of P_4 is known are needed to further confirm or discard the PSG model of the inner acceleration region in pulsars. This is very important for understanding the mechanism of coherent pulsar radio emission.

Long-Term Evolution of the Anomalous X-ray Pulsar 4U 0142+61 from XMM-Newton (Poster)

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We present results obtained from 7 XMM-Newton observations of the anomalous X-ray pulsar 4U0142+61 taken between 2002-2007. During the first 4 observations taken between 2002-2004, we observe a long-term evolution of the pulse profile, pulsed fraction and spectrum. The pulse profile is observed to become more sinusoidal, while the pulsed fraction increases with time. These results support those derived using RXTE by Rim et al. (2006) and expand the observed evolution to energies below 2 keV. In addition, we find that these temporal changes are accompanied by a softening of the phase-averaged spectrum while the total flux is consistent with being constant. The remaining 3 observations were taken between 2006-2007, after the August 2006 burst observed from the source, and show that the evolution does not continue after this event. In addition, the large number of photons allowed us fit a wide range of spectral models to the data. We find that the standard blackbody plus power-law model does not provide the best fit to the emission from 4U0142+61. We will discuss our results in light of current models for these sources.

XMM-Newton constraints on EOS of matter at supra-nuclear density (Solicited Talk)

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Observations of low-mass X-ray binaries with XMM-Newton and Chandra turned out to have a profound impact on the study of the neutron star equation of state. Model fits especially to those cases where the accretion history is well known, such as quasi-persistent sources (sources that have accreted matter at a high rate for ∼10 years) provide good test grounds for theoretical models. Sources for which the distance is well known also provide important tests. Finally, constraints on the equation of state from spectroscopic observations have become feasible with XMM-Newton. I'll discuss the current state of the observations and indicate possible future observations that could help contrain the equation of state further.

Ultraluminous X-Ray Sources and X-Ray Binaries (Review Talk)

Philip Kaaret
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I will review our current understanding of ultraluminous X-ray sources and the accretion and jet production processes in X-ray binaries with emphasis on the areas where future observations with XMM-Newton could lead to significant advances in our understanding of these systems.

Hydrodynamical and Spectral Simulations of HMXB Winds (Contributed Talk)

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We describe the results of a research program to develop improved models of the X-ray spectra of cosmic sources such as X-ray binaries, CVs, and AGN in which UV line-driven mass flows are photoionized by an X-ray source. Work to date has focused on high-mass X-ray binaries (HMXBs) and on Vela X-1 in particular, for which there are existing high-quality Chandra HETG and XMM-Newton RGS spectra. Our research program combines FLASH hydrodynamic calculations, XSTAR photoionization calculations, HULLAC atomic data, improved calculations of the line force multiplier, X-ray emission models appropriate to X-ray photoionized plasmas, and Monte Carlo radiation transport, thus combining and extending the work of Blondin et al. and Watanabe et al. We will present animations of the relevant physical quantities (density, temperature, ionization parameter, velocity) from a FLASH three-dimensional time-dependent simulation of Vela X-1, maps showing the emissivity distributions of the X-ray emission lines, and a preliminary comparison of the resulting synthetic spectra to the Chandra HETG spectra.

This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

A Model for Pulsed X-Ray Emission from Radio Pulsars (Poster)

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Thermal X-ray emission seems to be a quite common feature of the radio pulsars. On the other hand characteristics of such radiation allow us to get a lot of information about the polar cap region of the pulsars. Observations suggest the assumption that the pulsar magnetic field at the stellar surface essentially differs from the pure dipole field. The model assumes that the source of the pulsar activity is associated with the Partially Screened Gap operated in the Inner Acceleration Region above the polar cap where the electric field has a component along the magnetic field lines. The particles (electrons and positrons) are accelerated in both directions: outward and toward the stellar surface. Consequently, outstreaming particles generate the magnetospheric X-ray emission while the backstreaming particles heat the surface and provide necessary energy for the thermal emission. We model various possible configurations of the surface magnetic field and demonstrate that the curvature and structure of the field lines can be of the kind that naturally allows interpretation of observations. In some cases the curvature photons can be absorbed in the region of the closed field lines. The created pairs propagate along the closed field lines and heat the stellar surface near the local poles. Then the estimated area of the X-ray emitting hot spot can be even bigger then the conventional dipolar polar cap surface, which is the case of PSR J1119-6127.

XMM-Newton results on magnetars (Solicited Talk)

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I will review the XMM-Newton observations of magnetars and other isolated neutron stars possibly related to this class of objects. I will also briefly outline some suggestions for future programs on these objects.

The NS kHz QPOs: ISCO, Stella, Abramowicz-Kluzniak and/or total precession? (Poster)

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General belief dominating in the astrophysical community links the observed neutron star kHz QPOs to the orbital motion near the inner edge of an accretion disc. Considering the Hartle-Thorne metric we have compared the best fits relevant to several orbital QPO models for number of atoll sources. As previously realized, the relativistic precession model matches the observation for rather high neutron star masses ($M > 2M_{\odot}$) and angular momenta (j = 0.3-0.5). On the other hand the 3:2 epicyclic resonant model requires masses $M \sim 1M_{\odot}$. We have found that the identification of the upper QPO mode with the Keplerian frequency and the lower QPO mode with the total precession frequency (defined as a difference of the epicyclic frequencies) provides fits having chi-square almost one order lower than those of Stella and Vietri, and implies lower angular momenta and masses. These results together with some other significant indices including ratio clustering and rms amplitude evolution suggest that the kHz QPOs in atoll neutron star sources origin from resonances between oscillations with the Keplerian and total precession frequency occuring very close to the marginally stable circular orbit.

Chapter 4

Session C: SNRs and the Interstellar Medium

Mapping the Hot ISM Using X-Ray Shadowing Towards Infrared Dark Clouds (Poster)

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We present results from X-Ray shadowing experiments toward three infrared dark clouds (IRDCs) using *XMM-Newton*. X-Ray shadowing is the only known method of determining the distribution of hot plasma in the plane of the Milky Way. A good shadowing foreground source must have a high column density to produce strong absorption and a known distance to provide information on the hot plasma distribution. IRDCs are ideal X-ray shadowing targets due to their high extinction ($>$ 2 mag at 8μm) and very high column densities ($\sim$ 10^{23}–10^{25} cm^{-2}). Their distances can be found from HI self-absorption studies and morphological matches with molecular gas traced by ^{13}CO emission. Our pilot study of three IRDCs focuses on clouds near 30° Galactic Longitude and distances spanning 3 to 5 kpc from the Sun. We find absorption toward one IRDC and significant upper limits toward the two other clouds. We are planning a larger X-ray shadowing survey that will map molecular clouds at varying distances along neighboring lines of sight and that will eventually cover multiple sky regions. With these data we hope to determine the three-dimensional distribution of hot plasma in the Galactic plane, which would provide important information about the evolution of the interstellar medium and constraints on the energy balance and chemical evolution of our Galaxy.

SNR, PNe and Superbubbles: prospects for new XMM-Newton observations (Review Talk)

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After a brief review of the most important results obtained in the last years on SNRs, PNe and Superbubbles, I will identify the open scientific questions and the specific contribution that can be made in the X-ray domain with XMM-Newton.

The ejecta structure of the Oxygen-rich SNR Puppis A revealed by XMM-Newton (Poster)

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We report on the first results of our analysis of five XMM-Newton observations of a Galactic O-rich supernova remnant Puppis A. These data cover nearly entire remnant in X-rays. The true-color image indicates that hard, blue X-ray emission is enhanced across Puppis A from northeast to southwest. This feature appears to be foreground absorption effect. The equivalent width (EW) images for O, Ne, Mg, Si, and S reveal line-enhanced regions of these elements, while no such enhancement is found in the Fe EW image. The detected line enhancements are likely caused by overabundant metal-rich ejecta. Furthermore, several small line-enhanced features are positionally coincident with fast-moving O-rich optical knots. Since they are believed to be recoiled metal-rich ejecta, expelled to the opposite direction against the high-velocity central compact object, it is suggested that the metal-rich ejecta disclosed here are also parts of the recoiled materials.

Spectroscopic Study of the Galactic Center X-Rays with Suzaku (Solicited Talk)

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The diffuse X-ray emissions from the Galactic center (GCDX) are observed with the X-ray Imaging Spectrometer (XIS) on Suzaku. The high-energy resolution and the low-background orbit provide excellent spectra of the GCDX. The results of the Galactic center (GC) observations are; (1) the origin of the 6.7/7.0 keV lines is not a charge exchange process, but is collisional excitation in hot plasma, (2) the majority of the X-ray emission is not an integrated flux of unresolved point sources, but is diffuse, (3) new SNR candidates are found, (4) the 6.4 keV line is not fluorescence by electrons but by X-rays, and (5) the 6.4 keV clumps at Sgr B2 show a long-term (several years) variability in the morphology and flux.

A high resolution survey of the metal abundances in the Vela SNR (Contributed Talk)

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F. Bocchino

We present the preliminary results of the combined analysis of several XMM-Newton EPIC observations of the Vela SNR, including regions with a broad range of distances from the center of the remnant. We study with high resolution the spatial distribution of the physical and chemical properties of the X-ray emitting plasma on this large scale. We find inhomogeneous patterns of abundances of O, Ne, Mg, and Fe, with unexpected highly enhanced abundances of Ne and Mg. These results support a possible association of some X-ray emitting knots with either stellar fragments, or wind clumps from the progenitor star. This would imply that large and evolved SNR shells may provide new clues for the study of the physical and chemical properties of the ejecta and the circumstellar medium (CSM). We conclude that a large-area XMM-Newton survey of the Vela shell may yield constraints on the mechanism of the SN explosion and on the interaction of the shock with the CSM.

Preliminary Results from the Pricipal Component Analysis of the Cygnus Loop (Poster)

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H. Tsunemi

In 2002, XMM-Newton observed the Cygnus Loop supernova remnant at 8 positions for about 13ks each. We divided each field of view into smaller regions such that each region has at least 5000 events/MOS camera which resulted in 902 regions in all. Due to the large number of regions, we decided to apply principal component analysis to investigate this remnant. We present our preliminary results from this analysis.

Using X-ray observations to identify the particle acceleration mechanisms in VHE SNRs and "dark" VHE sources (Solicited Talk)

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Very high energy (VHE) gamma-ray observations have proven to be very successful in localizing Galactic acceleration sites of VHE particles. Observations of shell-type supernova remnants (SNRs) have confirmed that particles are accelerated to VHE energies in supernova blast waves; the interpretation of the gamma-ray data in terms of hadronic or leptonic particle components in these objects nevertheless relies strongly on input from X-ray observations. The largest identified Galactic VHE source class consists of pulsar wind nebulae, as seen in X-rays. Many of the remaining VHE sources remain however unidentified until now. With X-ray observations of these enigmatic "dark" objects we hope to solve the following questions: What is the astrophysical nature of these sources? Are they accelerating predominantly electrons or hadrons? And what is their contribution to the overall cosmic ray energy budget? The talk aims to provide an overview over the identification status of the Galactic VHE source population.

Chapter 5

Session D: Galaxies and Galaxy Surveys

Tidal disruption events from the XMM-Newton Slew Survey (Poster)

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R.D. Saxton, A.M. Read, M.J. Freyberg, B. Altieri, M. Sanchez-Portal

The paradigm that the nuclei of non-active galaxies are occupied by quiescent concentrated dark objects was predicted long ago by theory. This conjecture can be tested by the detection of X-ray outburst radiation due to stars tidally disrupted by a nuclear supermassive black hole.

Two optically non-active galaxies have been detected with XMM-Newton during slew observations in full agreement with the tidal disruption model. Here we present follow-up observations of both objects within the scenario discussed above.

X-ray selected normal galaxies outside the local Universe (Solicited Talk)

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Surveys by the XMM-Newton and the Chandra missions have identified normal galaxies outside the local Universe at comsologically interesting redshifts. This development has opened the opportunity to explore the evolution at X-ray wavelengths of the dominant population of the Universe: normal galaxies powered by stellar processes rather than accretion on a supermassive black hole. The unique feature of X-rays is that they are the only tool available to directly probe the X-ray binaries and the hot gas in galaxies, providing complementary information on their evolution compared to other wavelengths. In this talk I will review the status of current X-ray surveys of normal distant galaxies and I will discuss future prospects with XMM.

On the prospects of an SMC survey with XMM-Newton (Contributed Talk)

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W. Pietsch

XMM-Newton surveys of the local group galaxies M31 and M33 yielded a tremendous wealth of data which can be used for detailed population studies of the X-ray sources in these galaxies and to draw conclusions on our own Galaxy. Due to their proximity the Magellanic Clouds are in principle best suited for such studies. However, their large area on the sky so far prevented such projects. Meanwhile about 25 fields were observed by XMM-Newton in the SMC. We started a homogeneous analysis of the archival SMC data in order to obtain an intermediate inventory of the X-ray sources in the SMC region. Although incomplete, this data set allows us to investigate the populations of supersoft X-ray sources, supernova remnants (most of which can be nicely resolved) and the very numerous high mass X-ray binaries in the SMC. We discuss first results and the prospects of a complete X-ray survey of the SMC with XMM-Newton.

Galactic Source Populations (Review Talk)

Christian Motch
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The landscape of Galactic X-ray sources made of accreting binaries, isolated objects and active stellar coronae has been significantly modified by the advent of the Chandra, XMM-Newton and INTEGRAL satellites. New brands of relatively low X-ray luminosity X-ray binaries have been unveiled in the galactic disc, while deep observations of the central regions have revealed large numbers of X-ray binaries of so far loosely constrained nature. Because of the high spatial resolution needed and faint X-ray luminosities generally emitted, studying the dependency of the X-ray source composition with parent stellar population, galactic disc, bulge, nuclear bulge, etc., is only practicable in our Galaxy. The evolutionary link between low Lx X-ray binaries and classical X-ray luminous accreting systems is still open in many cases. In addition, the important question of the nature of the compact sources contributing to the Galactic ridge hard X-ray emission remains unsettled. We will review the most important results gathered by XMM-Newton over the last years and show how future observations could be instrumental in addressing several of these issues.

The X-ray Source Population of the Andromeda Galaxy M 31 (Solicited Talk)

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First studies of the X-ray source population of M 31 were performed with the Einstein observatory and ROSAT. High resolution Chandra observatory images not only spatially resolved the center area but also supernova remnants (SNRs) in the galaxy but also led to source catalogues of restricted areas with high astrometric accuracy. Also luminosity function studies and studies of individual sources based on Chandra and XMM-Newton observations led to a better knowledge of the X-ray source population. An XMM-Newton source catalog based on archival observations, revealed more than 850 sources down to a 0.2-4.5 keV luminosity of 10^{35} erg s^{-1}. EPIC hardness ratios as well as informations from earlier X-ray, optical, and radio catalogues were used to distinguish between different source classes (SNRs, supersoft sources (SSSs), X-ray binaries (XRBs), globular cluster sources within M 31, and foreground stars and objects in the background). However, many sources could only be classified as hard. They may either be XRBs or Crab-like SNRs in M 31 or background sources. Two of the globular cluster sources could be identified as low mass XRBs with a neutron star as compact object as they showed type I X-ray bursts. Many of the SSS were identified as optical novae. Inspired by these results an XMM-Newton survey of the entire D_{25} disk of M 31 and a dedicated program program to monitor X-ray counterparts of optical novae in M 31 was started. We will report first results and implications for further nearby galaxy studies.

Monitoring of SgrA* and neighbouring galactic center transients with XMM-Newton (Contributed Talk)

Delphine Porquet
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The Galactic center harbors at its dynamical center Sgr A*, the closest supermassive black hole (SMBH). In addition, this region is populated by accreting compact objects, such as neutron stars and black hole binaries which are often transient in nature and span several orders of luminosity (from quiescent to outburst state). Surprisingly, SgrA* luminosity is found to be several orders of magnitude lower than the expected Eddington luminosity. The recent discovery of X-ray flares from Sgr A*, that are believed to originate within just a few Schwarzschild radii of the black hole event horizon, has provided new exciting perspectives for the understanding of the accretion and radiation mechanism at work in this peculiarly faint SMBH. We will review the results obtained thanks to the past seven years of XMM-Newton monitoring of SgrA* and of the neighbouring X-ray transient sources. The unique throughput of XMM-Newton combined with multi-wavelength observations are crucial to answer general questions on accretion processes in compact objects, from compact objects to low-luminosity AGN.

Diffuse Galactic X-ray Emission (Review Talk)

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We review recent progress in understanding the various components and processes which contribute to the extended X-ray emission observed from the disk, bulge and nucleus of our Galaxy. We also compare the properties of our own system to those of other nearby normal galaxies. The case for devoting a substantial allocation of future XMM-Newton observing time to the mapping of the inner Galaxy is also explored.

Chapter 6

Session E: Active Galaxies

The NH distribution of Seyfert galaxies: Final X-ray results (Poster)

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I. Georgantopoylos

We present the X-ray spectral analysis of all ($D < 50$ Mpc) Seyfert galaxies. The data are obtained from Ho et al (1997). Our sample, is optically selected complete in magnitude B and distance limited. It consists of 42 Seyfert galaxies (9 of type 1 and 33 of type 2). The X-ray spectral analysis shows that about 75 per cent of these objects present column densities greater that 10^{22} cm^{-2}. At least 30 per cent of these sources could possibly be associated with Compton thick AGN. These results are in good agreement with previous findings of Cappi et al (2005) and also agree with the predictions of unified models of Seyfert galaxies.

XMM observations of AGN outflows (Contributed Talk)

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AGN kinetic luminosity is increasingly invoked as a major contributor to the formation and evolution of supermassive black holes, their host galaxies, the surrounding IGM and cluster cooling flows. All these processes are combinely known as AGN feedback. The outflows are detected as blueshifted absorption troughs in the AGN's spectrum. The X-ray phase of these outflows carry most of the kinetic luminosity, but details are scarce. I will discuss the important scientific returns of deep simultaneous X-ray/UV spectral campaign directed at warm absorbers. I will also discuss the problematic nature of the so called "relativistic outflows" inferred from X-ray CCD observations.

Multiwavelength analysis of AGN with the XMM-Newton archive (Poster)

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M. Guainazzi, G. Matt, N. Fonseca Bonilla

A large and systematic use of the XMM-Newton archive represents one of the major legacies of this highly successful mission. In particular, multiwavelength analysis on large samples of Active Galactic Nuclei (AGN) provides an excellent tool to understand the physics of these objects. We present the largest catalog of XMM-Newton targeted AGN with high SNR X-ray spectra published so far. It includes all the radio-quiet objects observed by XMM-Newton, in targeted observations of the AGN panel, whose data are public as of March 2007, for a total of 157 unobscured and 100 obscured sources. The principal X-ray properties of the catalog are complemented by multiwavelength data found in the literature (optical magnitudes, radio fluxes, Hbeta FWHM, BH masses). We present here results extracted from this catalog, in particular the anti-correlation between the neutral iron narrow emission line and the X-ray luminosity (the 'Iwasawa-Taniguchi effect'), and the correlation between the soft to hard X-ray luminosity ratio and the Hbeta FWHM.

Statistics of relativistic broadened Fe K-alpha lines in AGN (Contributed Talk)

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I. de la Calle Perez, A. Longinotti, M. Guainazzi, S. Bianchi

The relativistically broadened Fe K-alpha line emitted in Active Galactic Nuclei (AGN) is still matter of debate among the AGN community. Although in some bright objects the presence of a skewed and asymmetric line profile at 6.4 keV has been ascertained, recent works seem to exclude that the broad Fe line is a common feature of AGN. We have undertaken a systematic spectroscopic study on 158 AGNs in the XMM-Newton archive. The aim of our study is two-fold: a) to determine how often relativistic effects from an accretion disc are detected in X-ray spectra of AGN; b) to derive average sample properties of the innermost regions of the accretion flow.

Some of the results of this work will be presented in this talk:

1) broad relativistic lines are present in 50% of XMM-Newton spectra;

2) there is no significant difference between type 1 and type 2 objects;

3) the average Equivalent Width is consistent with the theoretical predictions for plane-parallel accretion discs;

4) relativistic lines are more common in low luminosity AGN.

A Catalogue of XMM-Newton detected BL Lacs (Poster)

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N. Loiseau

A XMM-Newton catalogue of BL Lac X-ray properties is presented based on cross-correlation of the 1122 BL Lac objects listed in the 12th edition of the Veron-Cetty and Veron (2006) catalogue. X-ray counterparts were searched for in the field of view of all pointed observations available in the XMM-Newton Archive (XSA) that were public before August 2006. Data from the three EPIC cameras were uniformly re-analyzed on a computer grid, available at ESAC, using the latest SAS software version and updated calibration files. The results of the analysis are presented in terms of the spectral properties of the sample in the 0.2 – 10 keV energy band.

A view of absorbed AGN (Poster)

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L. Bassani, A. Malizia, M. Molina, F. Panessa

We present a broad-band study of absorbed AGN observed with INTEGRAL, XMM and Chandra. The column density of the absorbing gas suggests that these objects are all Compton thin. This results is also confirmed by the ratios F_X/OIII. The compton reflection we measure is not immedialely compatible with a scenario in which the absorbing and reflecting media are one and the same, while the (neutral) iron line detected in the spectra is narrow and consistend with being produced in the absorbing gas. At lower energies there is clear evidence of a soft component (reproduced with a thermal and/or scattering component). The high energy cut-off (a lower limit in some cases) in found in all sources of our sample and the range of values are in good agrement with that found in other Seyfert.

Broad iron lines in AGN (Solicited Talk)

Andrew Fabian
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Solicited Talk.

Properties and two-point angular correlations of point-like sources (Poster)

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P. Gandhi, L. Disseau, F. Pacaud, M. Pierre, E. Gosset, J. Surdej

We have analyzed X-ray sources detected over 4.2 pseudo-contiguous sq. deg. in the 0.5–2 keV and 2–10 keV bands down to fluxes of 2×10^{-15} and 8×10^{-15} erg s^{-1} cm^{-2} respectively, as part of the *XMM-Newton* Large Scale Structure Survey. The log N-log S in both bands shows a steep slope at bright fluxes, but agrees well with other determinations below $\sim 2 \times 10^{-14}$ erg s^{-1} cm^{-2}. The detected sources resolve close to 30 percent of the X-ray background in the 2–10 keV band. We study the two-point angular clustering of point sources using nearest neighbours and correlation function statistics and find a weak, positive signal for ~ 1130 sources in the 0.5–2 keV band, but no correlation for ~ 400 sources in the 2–10 keV band below scales of 100 arcsec. A sub-sample of ~ 200 faint sources with hard X-ray count ratios, that are likely dominated by obscured AGN, does show a positive signal with the data allowing for a large angular correlation length, but only at the ~ 2 (3) σ level.

About testing the unified scheme upon X-ray selected AGN in the [2-10] keV band (Poster)

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P. Gandhi, E. Gosset, P.G. Sprimont, J. Surdej, F. Pacaud, M. Pierre

We present a sample of 99 spectroscopically identified ($R \leq 22$) X-ray selected point sources in the XMM-LSS survey which are significantly detected in the [2-10] keV band and have more than 80 counts in the [0.5-10] keV band. We have performed an X-ray spectral analysis for all these X-ray sources in order to assess whether they are intrinsically absorbed or not. Their optical classification is based on the measured FWHM of the permitted emission lines. The sample turns out to contain 61 broad line AGN, 35 narrow emission line galaxies and 3 absorption line galaxies. We find at most a mild correlation between the X-ray and optical classifications, with 32 of the 99 X-ray sources having discrepant X-ray and optical classifications. Taking into account the possible dilution of the AGN by their host galaxies and other plausible effects, we finally conclude that most of the 32 discrepant cases can be accounted for, without any need to alter AGN unification models, as their predictions are not met for only 5% of the objects.

X-raying the circumnuclear matter in AGN: the XMM-Newton legacy (so far) (Contributed Talk)

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S. Bianchi, M. Dadina

In this talk we review what we have learned so far on the nature of the circumnuclear gas surrounding Active Galactic Nuclei from XMM-Newton. The combination of high-resolution observations in the energy domain with the RGS and in the spatial domanin with Chandra has allowed us to achieve for the first time a clear picture of the geometrical distribution and physical nature of the gas. In some cases of extremely (> 1 kpc) Extended X-ray Narrow Line Regions, the recent history ($< 10^5$ years) of the nuclear activity and of the mass loss in nuclear outflows can be reconstructed. Finally, we will discuss the impact of our results on models describing the cosmological evolution of AGN.

High spectral resolution observations of AGN (Solicited Talk)

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In this talk I will give an overview of some highlights of high spectral resolution observations of AGN, mainly obtained with the RGS of XMM-Newton, and future prospect for such observations with XMM-Newton.

X-raying Close Pairs of Interacting Galaxies (Poster)

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E. Jiménez-Bailón, M. Guainazzi

We report on XMM-Newton and Chandra data of a sample of close pairs of similar sized interacting galaxies. X-rays can unveil hidden active nuclei, providing a method to discover binary AGNs and to characterize the galaxies activity in function of the pair separation, their morphology and other parameters that indicate the stage of the merging process.

Stacked spectra from a large sample of type 1 AGNs in the XMM-Newton archive (Poster)

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M. Guainazzi, S. Bianchi, I. de la Calle Perez, M. Dovciak

The presence of a relativistically broadened Fe K-alpha line emitted in Active Galactic Nuclei (AGN) is still matter of debate among the AGN community.Recent works seem to exclude that the broad Fe line is a common feature of AGN.

We present stacked spectra of a large sample composed by 157 archival observations of AGN, expanding the work presented in Guainazzi et al. 2006. Several tests have been performed using this technique: we tested different models for the continuum underlying the broad line and compared the results for the following groups of AGN: Seyferts and Quasars and Broad Line and Narrow Line objects. Narrow Line sources tentatively show a more prominent red wing in the profile of stacked residuals when comparing to Broad Line sources. This intriguing result may be interpreted as an intrinsic difference in the accretion mechanism of the two classes.

The XMM-LSS Survey: multifrequency characterization of the hard AGN population (Poster)

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for the XMM-LSS collaboration

We present an XMM/CFHTLS/SPITZER study of the hard (2-10 keV) AGN detected in the central part of the XMM-LSS survey (XMDS). The multi-frequency coverage enables a very high identifcation rate. We have developped an efficient fitting procedure of the spectral energy distributions. This allows both photometric redshifts to be determined with unprecedented accuracy and detailed insights into the physics of the objects.

We find a large population of optically obscured AGN (i.e. objects with SEDs fitted by AGN 2 or star forming galaxy templates). The stacked X-ray spectra of AGN with type 1, type 2 and SF SEDs are increasingly hard. The fraction of optically obscured AGN decreases with increasing luminosity/redshift while the fraction of X-ray absorbed AGN does not change significantly, suggesting a decoupling of gas and dust in the close environment of AGN at high luminosities.

We present the 2D X-ray AGN correlation function over the first XMM-LSS 5 $\deg^2$, the largest deep area so far. The results also provide constraints on the hard population.

Active galaxies (Review Talk)

Giorgio Matt
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Review talk.

XMM and Hard X-ray Surveys of AGN (Solicited Talk)

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The Swift BAT all sky survey is the largest and most sensitive all sky survey in the 15-100 keV band and provides an unbiased selection of active galaxies necessary for answering many of the fundamental questions concerning AGN numbers, types and evolution.

I will present results from XMM , Suzaku and Swift XRT follow-up observations of hard x-ray sources detected by the Swift BAT. Many of the source spectra are complex and differ from those previously reported. Simultaneous fits of the BAT and x-ray data allow estimates of which objects are Compton thick. I will also present the logN-log S and luminosity function of the BAT selected sources and discuss how XMM can make a major contribution to further study of these objects.

Hard X-ray observation of the M81 nucleus with Suzaku (Poster)

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T. Itoh, K. Makishima

We report spectral and timing results from a long (100 ks) Suzaku observation of the M81 nucleus, a typical low-luminosity active galactic nucleus, conducted on 2006 May 5th. The 2–10 keV luminosity in our observation hit a historical minimum, $\sim 1.4 \times 10^{41}$ ergs/s, which is a quarter of that at the BeppoSAX observation. We nonetheless detected its signal up to $\sim$40 keV, with the Hard X-ray Detector (HXD). The X-ray flux varied by 10% during the observation, but the spectral shape remained unchanged. The 2–10 keV spectrum measured with the XIS is well described by a power law continuum, and an iron Kα emission line complex which is similar to that observed by XMM-Newton. While the complex cannot be modeled by a single broad line, it can be represented successfully by three narrow lines at energies of $\sim$6.43, $\sim$6.70, and $\sim$6.98 keV, with the equivalent widths of $\sim$47, $\sim$49, and $\sim$34 eV, respectively. The energy spectrum above 10 keV, measured with the HXD, showed an excess above a single power-law determined by the XIS in energies below 10 keV. This suggests the existence of a cold reflection continuum, which is commonly observed from more luminous Seyfert galaxies.

Chapter 7

Session F: Clusters of Galaxies & the WHIM

The search for the missing baryons: gone with the WHIM (Review Talk)

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Big-bang nucleosynthesis and Cosmic Microwave Background anisotropies are consistent with the baryon fraction in the Universe being around 4.5 per cent. However, the sum of stars and gas in galaxies in clusters amounts to around 2.5 per cent only. Simulations predict that the remaining baryons reside in a shock heated warm and hot Intergalactic Medium. Its current temperature is uncertain, depending to the amount of photoionisation provided by AGN and stars. Its metal content is also uncertain. X-ray absorption towards bright background sources offers the best chance to detect OVII or OVIII from WHIM filaments, but it requires very large signal to noise in high spectral resolution soft X-ray spectra. The detection of intervening absorption with Chandra and XMM is, at the moment, controversial to say the least. I will discuss strategies that could be used with XMM-Newton to further significantly this subject until the next generation of X-ray observatories are available.

Planck Cluster Survey (Solicited Talk)

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On behalf of the Planck Working Group 5

The Planck satellite (launch scheduled for 2008) will detect thousands of galaxy clusters via the Sunyaev-Zel'dovich (SZ) effect and produce a full-sky cluster catalog covering an unprecedented volume. We will discuss the expected characteristics and scientific reach of this catalog for cosmology and cluster studies. Taking advantage of the survey volume, we will in particular emphasize the exciting and unique possibilities for XMM follow-up of a sub-sample of massive, high-redshift clusters.

Statistical Properties of Clusters (Review Talk)

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Statistical properties of galaxy clusters are obtained from studies of representative cluster samples as obtained e.g. from flux limited X-ray cluster surveys. The goals of such studies are a census of the cluster population in general, the assessment of clusters as an approximately self-similar class of objects, and the study of cluster evolution which can only be done by a statistical description of the change of the cluster population. We illustrate this topic on the basis of detailed cluster studies on cluster samples drawn from X-ray surveys at various redshift. To extent such studies to higher redshift ($z > 1$) to increase the leverage of our understanding of galaxy cluster evolution even larger programs than presently conducted are necessary. It will be pointed out how such a very large program can form part of XMM-Newton's long term Legacy Program.

The evolution histories of six clusters of galaxies (Poster)

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G.B. Lima Neto

XMM-Newton now allows to map with unprecedented sensitivity the temperature, metallicity, pressure and entropy distributions of the X-ray gas in clusters of galaxies. Such maps have revealed that even when the X-ray emission appears smooth, evidence for past or present merging events can be found; they are therefore precious tools to trace the individual histories of cluster formation and evolution.

We have derived such maps for six medium redshift clusters and show that all have undergone one or several mergers. We discuss their formation and evolution histories, and propose merging scenarios for some objects of our sample.

Properties of x-ray point sources in the clusters of galaxies (Poster)

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E.N. Ercan, F. Gok, G.I. Gun, E. Aktekin, T. Guver

Three nearby cluster of galaxies A2255, A194, A1060 have been analyzed for the X-ray point like source properties with XMM-Newton data. The cumulative log(N)-log(S) is calculated and compared with the blank field of Lockman Hole. A significant source-density excess (> 3 sigma) was found from the cluster regions. Correlation of X-ray to optical luminosity (Lx/LB) ratios is also studied. The optical observation of A2255 is performed by TUBITAK telescope RTT-150. The cluster galaxies are found to be brighter than the field compact galaxies. Based on the results we try to address the poperties of galaxies in clusters and environmental influences of the WHIM on galactic nuclear activities.

Study on Spatial Distributions of Metals and the Other Cluster Components (Poster)

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T. Kitaguchi, K. Makishima

Spatial metal distribution in the ICM reflects evolution of galaxy distribution and supernova activities. We studied 12 nearby clusters of galaxies observed with XMM-Newton, and compared the distributions of metals with galaxies, the ICM, and total mass. We found that the distribution of iron is similar to that of the total mass, rather than the ICM. This is reasonable from the viewpoint that galaxies distribute along the dark matter distribution. However, at the center, iron-mass-to-light ratio (IMLR) of the 12 clusters decrease more than one order of magnitude from the peripheries. This means that the iron is deficient at the center compared with galaxy light. One possible scenario is that galaxies distributed more uniformly than now in the age of cluster formation, and have fallen toward the center with providing the iron created via type-Ia supernovae. Recent studies of oxygen distribution using Suzaku revealed that the oxygen distribution is spatially more uniform than the iron, indicating different history between type-Ia and type-II supernovae. Future missions which enable to study spatial metal distributions of distant clusters will determine the history of the galaxy distribution and metal enrichment to the ICM.

Suzaku study of hard X-ray emission from nearby galaxy clusters (Poster)

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K. Nakazawa, K. Makishima, N.Y. Yamasaki, N. Ota, A. Furuzawa

Using the HXD onboard Suzaku, we searched nearby galaxy clusters for hard X-ray emission, and detected positive signals above the sum of the non X-ray background and the cosmic X-ray background from three rather relaxed clusters; the Perseus cluster, the Centaurus cluster, and Abell 1060, in the energy range of 10-60, 10-30, and 10-20 keV, respectively. Within current uncertainties in the spectral and angular responses of the HXD, the detected hard X-ray signals can be explained as high-energy ends of the thermal emission from the hot intra-cluster medium. As a result, the 1σ upper limit on 20-80 keV non-thermal luminosity is obtained in the three objects as several 10^{42} erg sec^{-1} if modeled by a single powerlaw with a photon index of 2.0.

XMM Newton in the era of observational cosmology (Contributed Talk)

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J. Mittaz, N. Werner, M. Bonamente, J.S. Kaastra

Two important contributions of X-ray astronomy to cosmology, both concerning how the X-ray properties of clusters may scrutinize the 'standard model', will be presented in the context of past and future XMM observations.

First is the cluster soft X-ray excess and its related WHIM phenomena. There is now a growing concensus that the strong central soft excess seen in some clusters is of non-thermal origin, chiefly because the cluster O VII line stubbornly evades detection. I will examine such spectra as measured by XMM, Suzaku, and Chandra, and discuss how a future, longer exposure XMM pointing may clinch the O VII line from a lower metallicty warm gas, as well as the form of the spectral distortion which enables discrimination of a power-law from warm thermal emission. This investigation directly implicates the mass budget of baryons in a cluster, a quantity of immense cosmological significance not only because of the baryon fraction problem, but also the SZ effect.

On the latter, which is the second X-ray to cosmology connection, our group made the first attempt ever in checking a large sample of clusters by analyzing both WMAP and ROSAT data. In this way we revealed a major discrepancy, confirmed recently by Bielby & Shanks(astro-ph/0703470), in that WMAP clusters hardly exhibit any SZ effect, not even with an unresolved point spread profile. I will summarize these findings and demonstrate how they represent a highly effective way in which X-ray data can be used to check the reliability of the claimed associations between observed CMB anisotropies and cosmology.

Finally, I will show how PLANCK and XMM would together form a substantial advance in this effort than what WMAP and ROSAT did.

Suzaku observations of clusters of galaxies (Solicited Talk)

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T. Ohashi, K. Sato, N.Y. Yamasaki, K. Nakazawa, Y. Ishisaki

We review the results of Suzaku observations of intraclustermedium. With Suzaku, the O, Mg, Si, S, and Fe abundances of the intracluster medium of clusters of galaxies were measured with good accuracy, due to good energy resolution at the O line energy with low background. Metal mass to light ratios were derived and we will discuss the origin of the metals. The low background of the Suzaku also enables us to derive accurate temperature profiles of the intraclustermedium. We also review the results of search of bulk motions and hard X-ray emission.

Representative X-ray galaxy cluster samples up to $z \sim 0.6$ (Contributed Talk)

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J.H. Croston, E. Pointecouteau, H. Böhringer, M. Arnaud

I will present results based on the Representative XMM-Newton Cluster Structure Survey (REXCESS), an XMM-Newton Large Programme in which a total of 33 luminosity-selected nearby ($z < 0.2$) galaxy clusters have been observed. I will discuss preliminary results on the structural properties of the sample (gas density, temperature, entropy, etc) and on the scaling of various quantities. I will compare with preliminary results from the complementary XMM Large Programme on distant galaxy clusters, comprising 22 objects at $0.4 < z < 0.6$, also luminosity-selected. I will also discuss the expected long-term scientific outcomes of the combined projects.

The long-term evolution of the XMM-Newton background (Poster)

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R. Gonzalez-Riestra

The extensive observational database compiled after more than seven years of routine operations has allowed us to characterize the behavior of the background in XMM-Newton observations, in particular for EPIC-pn and RGS1.

We have studied the evolution of the background using all the available data of both instruments since the start of the mission until April 2007. We have found that the dominant parameter is the position of the S/C in its orbit, but it is not the only one, since there exists a marked difference between the behaviour of the background when moving away from perigee and when approaching to it.

We have not found any substantial long-term change in the behaviour of the background. It has neither increased nor decreased significantly since the beginning of the mission.

There is also a pronounced seasonal effect, independently of the part of the revolution considered.

Deep RGS Observations of Clusters (Contributed Talk)

Randall Smith
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R. Mushotzky

One of the premier results from XMM-Newton was the discovery that cooling flow clusters do not, in fact, cool. The discovery was the direct result of the non- or weak detection of Fe XVII and other low-temperature emission lines in the RGS. Although the RGS is the only high-resolution X-ray spectrometer able to measure extended sources (up to $\sim 1'$), relatively few deep (500+ ksec) observations of clusters have been done. We will discuss what has been learned from existing observations, which clusters are strong candidates for deeper observations, what calibration and software are needed to take full advantage of the observations, and, finally, what could be learned from these observations.

Chapter 8

Session G: Cosmology & Extragalactic Surveys

An XMM-Newton Legacy Survey of Infrared/Submillimetre Fields? (Solicited Talk)

David Alexander
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I will review the science that can be achieved when X-ray and infrared/submillimetre observations are combined and I will explore the unique parameter space that a large XMM-Newton survey of the current/planned infrared/submillimetre fields could explore.

XMM Cosmos results and perspectives (Solicited Talk)

Marcella Brusa
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G. Hasinger, A. Comastri, N. Cappeluti, G. Zamorani et al.

I will present the main results from the XMM-COSMOS project (the largest XMM program approved in two different AO) obtained so far, and in particular I will focus on: 1) the survey strategy and design; 2) the source counts in the hard band (5-10 keV) band; 3) the multiwavelength properties of (obscured) AGN; 4) the number density of high redhsift QSO; and 5) future perspectives.

Beyond the Lockman Hole: spectroscopy of the absorbed Universe (Contributed Talk)

Francisco J. Carrera
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X. Barcons

We propose to reach down to the confusion limit of XMM-Newton in the 5-10 kev band ($\sim$ 1800 sources per square degree), which would be reached at S(5-10keV)$\sim$1e-15 cgs in 2 Ms with a SNR $\sim$ 5. At that flux level 76% of the X-ray background in that band would be resolved. According to XRB synthesis models, at that flux level the number of unabsorbed AGN would be about half the number of absorbed AGN (the same proportion as in the latest 30-100 keV selected samples). The latter would be about equally represented by moderately (logNH=22.5) and heavily absorbed (logNH=23.5) Compton-thin AGN. Within the XMM-Newton FOV more than 200 such absorbed AGN, and about 9 Compton-Thick (logNH$\sim$24) AGN are expected to be detected.

Between 200 and 800 counts in the 0.2-10 keV spectral range ($\sim$ 70 in 5-10keV) would be collected from each source at that flux, sufficient to study the broad-band spectral properties of individual sources, and more than enough to perform detailed analysis of average spectra in flux or luminosity bins. This will settle the question of the distribution of Compton-thin absorption in AGN and make significant inroads into the abundance of moderately Compton-Thick AGN.

Extragalactic Surveys (Review Talk)

Andrea Comastri
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I will review the most important achievements obtained by XMM-Newton in the study of the extragalactic X-ray sky identify the most pressing open scientific questions and discuss the perspectives of future surveys and in particular the scientific cases for an extremely wide survey (several tens of square degree) and an ultra deep (several Megasec) pointing.

Clusters in deep XMM surveys (Contributed Talk)

Alexis Finoguenov
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I discuss a unique role, the XMM observations play in establishing a new area of cluster cosmology covering the $1 < z < 3$ Universe, at cosmic times when dark energy invaded the Universe. Using the examples of several completed XMM surveys, COSMOS/UDS/CDFS/CDFN/LH I review the current status, lessons and future goals of such surveys.

The census of highly obscured SMBH: X-ray observations of extreme Spitzer AGNs (Contributed Talk)

Fabrizio Fiore
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Highly obscured, Compton thick (CT) AGNs may be as numerous as unobscured AGNs at $z = 1 - 3$. However even the deepest X-ray surveys are inefficient to search for these elusive AGN, and, at present, only a handful of objects are known. Alternative selection criteria, combining infrared to optical photometry, were successfull to pin-point many CT AGNs. We selected a well defined sample of $\sim$ 50 CT AGNs by making use of the wealth of multiwavelength data available in the SWIRE survey over nearly 50 deg^2 and requiring extreme values of the 24 micron to optical flux ratio and bright 24 micron fluxes, which we demonstrate are reliable proxies of high luminosity and high obscuration. These extreme sources are expected to host the most luminous and obscured AGN in the high redshift Universe, and so they are ideal targets for XMM and Herschel. Covering to the desired depth all SWIRE fields is practically unfeasible with today instrumentation. A more efficient program would be to perform targeted observations of the candidate CT AGNs. The combination of X-ray and infrared information will be used to measure the number density of CT AGNs at $z > 1$, a step forward in completing the census of SMBH through the cosmic epochs.

Optical colours of AGN: obscured black holes in early-type galaxies (Poster)

Ioannis Georgantopoulos
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E. Rovilos

We investigate the optical colours of X-ray sources from the Extended Chandra Deep Field South (ECDFS) using photometry from the COMBO-17 survey. The X-ray sources populate both the "blue cloud" and the "red sequence" on the colour-magnitude diagram. However,sources in the "red sequence" appear systematically more obscured. HST imaging from the GEMS survey demonstrates that the nucleus does not affect significantly the observed colours, and therefore red sources are early-type systems. This comes in contrast to popular models of AGN evolution, which postulate that evolved AGN have swept away obscuring clouds during the last stages of their evolution. We discuss prospectives for a large area (100 $\deg^2$) XMM survey to explore AGN feedback models.

The XMM-LSS Survey (Solicited Talk)

Marguerite Pierre
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and the XMM-LSS consortium

The XMM-LSS Survey: cluster detection, multi-wavelength follow-up and cosmological modeling.

We present the main issues of cluster detection procedures in wide XMM medium surveys; special attention is given to the modelling of the selection function. X-ray cluster identification using the optical data is reviewed along with the physical analysis of cluster properties from the associated radio and infrared surveys.

We discuss the cosmological analysis of the XMM-LSS cluster sample, which is the largest XMM cluster sample to date with controlled selection effects. We further enlighten a number of questions pertaining to cluster physics evolution in the era of precision cosmology.

Cosmology: Getting the most of XMM (Contributed Talk)

Kathy Romer
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on behalf of the XCS collaboration

The XMM archive has yielded a large number of serendipitous cluster detections, out to at least z=1.5. The challenge now is to translate those detections into cosmological constraints. This talk will discuss several possibilities: 1. a large area ($\sim$ 200 sq. deg) contiguous survey in the SDSS strip 82 region in pointing mode, 2. a large problem of follow-up to improve spectroscopy of XCS clusters, 3. a Slew survey over a very large region ($\sim$ 1000 sq. deg) covering the SPT/DES overlap region.

Re examining the Cosmic Reference Frame Spectra (Poster)

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In this paper, we re examine the spectra of cosmic reference frames, starting from the nuclear up to the cosmological dimension and their inherent particle aggregations. Apparently, community of particles which act distinctly at lower levels soon looses their identity and then act as a group as we move across the entire cosmic reference frames. Ultimately, the observable Universe as we know it today may noy be communicating through worm holes ... rather it might just be acting as a cell in a much larger system much like a star system within a galaxy.

Contiguous and serendipitous surveys with XMM-Newton (Solicited Talk)

Mike Watson
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Pointed observations with XMM-Newton provide a serendipitous X-ray survey of $\approx$ 80 sq.deg. every year **for free**. In this context it is worth comparing the virtues of possible **planned, new** large-area surveys with what we already have from serendipitous coverage. I will discuss the issues - in particular survey requirements - in the context of the properties of the 2XMM Serendipitous X-ray Catalogue which is now complete and ready for release in July 2007.

Chapter 9

Session H: New opportunities for multi-wavelength & follow-up observations

XMM-Newton follow-up observations of a short gamma-ray burst (Poster)

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D. Pérez-Ramírez, M. Guerrero, A. de Ugarte Postigo et al.

XMM-Newton ToO follow-up observations of a short gamma-ray burst were combined with optical observations carried out with ground based telescopes. We discuss the possible counterparts found as result of these observations and their nature.

BiRD: A Browsing Interface for RGS Data (Poster)

Rosario Gonzalez-Riestra
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P.M. Rodriguez-Pascual

We present BiRD, a tool for browsing and quick-look analysis of RGS fluxed spectra. This tool provides access to RGS fluxed spectra uniformly processed with the latest versions of SAS and calibration files.

The BiRD interface allows to select spectra through a variety of parameters, such as (e.g.) date of observation, level of exposure or type of object. It also provides some basic visualization utilities, both for the RGS spectra and spectral images, as well as for the EPIC-pn images taken in parallel.

XMM-OM: the next decade (Contributed Talk)

Mathew Page
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on behalf of XMM-OM

I will describe the status and performance of the XMM-Newton optical monitor, and our expectations for the next 10 years. I will describe the catalogue of XMM-OM ultraviolet sources that is currently under construction, and its value in comparison (and in conjunction) with other catalogues from ultraviolet observatories. I will describe briefly a new observing mode that is being investigated by the OM team that may, if successfully commissioned, allow the OM to be used during slow slews of the spacecraft.

The XMM-Newton Slew Survey: Towards the Whole Sky (Contributed Talk)

Andrew Read
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R.D. Saxton, P. Esquej, M.J. Freyberg

To date, the publically available XMM-Newton slew data covers over 25% of the sky, and here we present for the first time this XMM-Newton 'slew-view' of the X-ray sky. The soft band (0.2-2 keV) sensitivity limit (6E-13 ergs/s/cm2) of the slews is close to that of the RASS, and in the medium (2-12 keV) band, the slew data goes significantly deeper (4E-12 ergs/s/cm2) than all previous large area surveys. Over 4000 individual high-significance sources have been so far detected to an excellent positional accuracy of 8", and a number of extremely rare high-variability events have been observed. Indeed, it is only with such a large area survey as this, that such events have a chance of being observed.

As XMM-Newton moves into the next decade, more and more of the sky will be observed, to a greater and greater depth, and many more unusual objects will be discovered. The slew survey will continue to provide exotic sources for follow-up observations, both with XMM-Newton and other (X-ray and multiwavelength) observatories. In paving the way for the proposed dedicated XMM-Newton 'slow-slew' observing mode, the slew survey provides an excellent complementary database and a wealth of knowledge and experience.

The power of slews to perform large area XMM observations (Poster)

Richard Saxton
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A.M. Read, P. Esquej, M.J. Freyberg, B. Altieri

XMM has usefully surveyed about 40 percent of the sky to date during its routine slewing manoeuvers. Data from 20 percent of the sky has been publically released, giving access to medium energy source fluxes poorly covered in previous surveys and establishing an interesting resource for variability studies. Here we look at the expected final legacy from the slew survey and investigate the benefits of slewing at slower speed over targeted areas.

The XMM-2dF Wide Angle Survey (XWAS) and future serendipitous survey prospects (Poster)

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M.G. Page, M.G. Watson, S. Mateos, F.J. Carrera, M. Krumpe, A. Schwope, Y. Xu

The XMM-Newton Survey Science Centre (SSC) is carrying out an identification and follow-up programme of serendipitous sources discovered in XMM-Newton observations. The goals of this survey include the detailed characterisation of the dominant X-ray source populations (e.g. AGN luminosity functions, absorption distribution and evolution, and the relationship between optical emission line and X-ray spectral properties) and the discovery of new, rare classes of sources. In addition to our ongoing core XID spectroscopic identification programme, we targetted over 3000 sources, spread evenly over 3 decades in X-ray flux, with the 2dF instrument on the AAT in 27 pointings including the LSS survey fields. Critically we have now identified over 1000 sources with $F_{0.5-4.5}$ keV $> 10 - 14$ erg/s/cm^2 which is an unsurpassed resource with which to investigate the AGN population around the break in the X-ray source counts.

We present the results of this work to date and discuss the prospects for wider characterisation of the growing serendipitous XMM catalogues based on such a medium sensitivity sample as a training set. We also discuss the use of new and archived optical and near-IR multiband imaging required to extend the survey to higher redshifts and e.g. investigate the relationship between photometric reddening and X-ray colour for particular classes of objects.

Chapter 10

Summary

Summary (Review Talk)

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