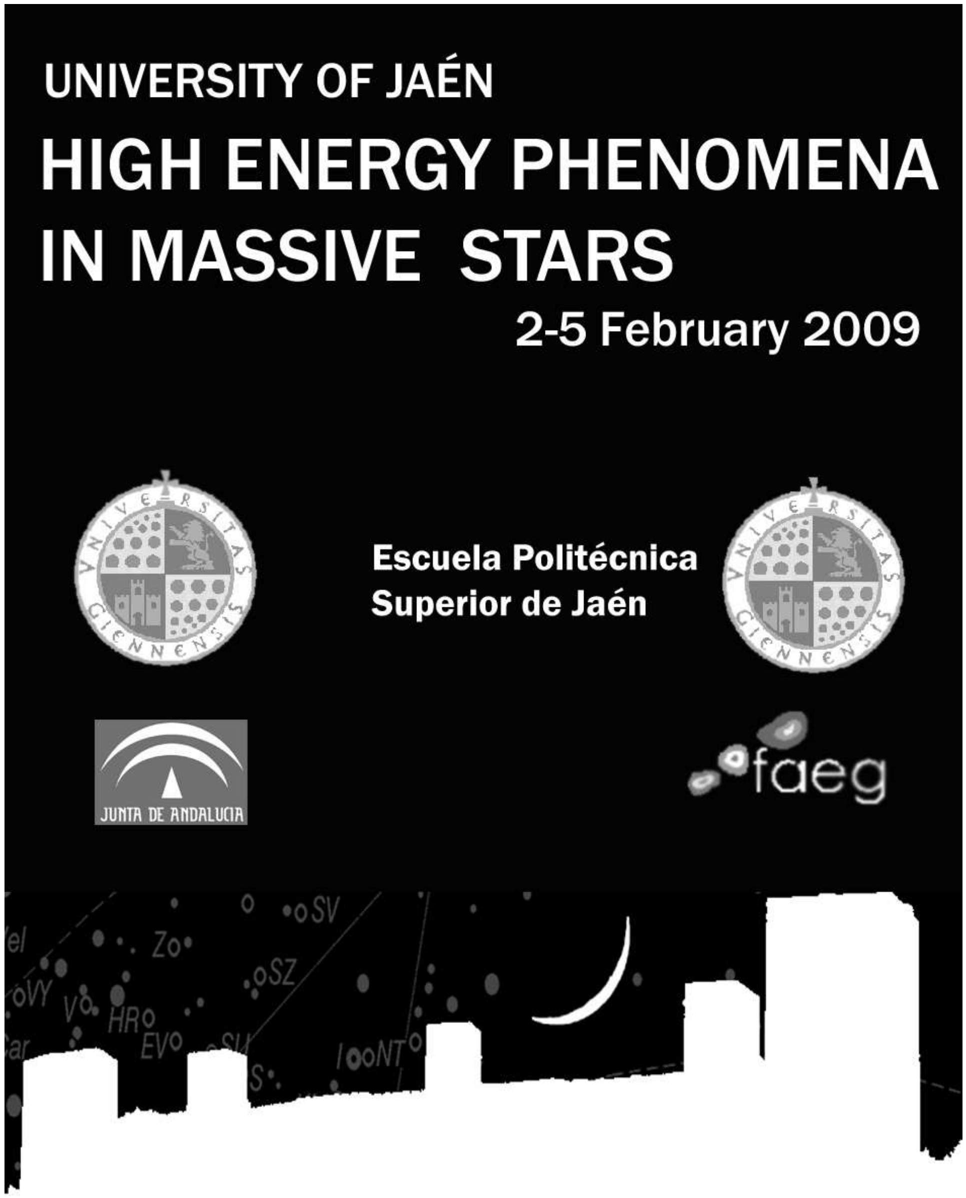

BOOK OF ABSTRACTS

Oral contributions

High-energy flares from jet-clump interactions in HMMQs

Anabella Araudo

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Abstract. High-mass microquasars (HMMQs) are binary systems formed by a massive star and an accreting compact object from which relativistic jets are launched. Considerable observational evidence supports the idea that the winds of massive stars are formed by clumps, which should interact with the jets in HMMQs. We present here a study of the interaction between a microquasar jet and a clump. Adopting a hydrodynamical approach, we calculate the spectral energy distribution resultng from the dominant non-thermal processes taking place in the interaction region: synchrotron and inverse Compton radiation from relativistic electrons, and gamma-rays from inellastic proton-proton collisions. Significant levels of X- and gamma-rays are predicted, with luminosities up to $10^{34} - 10^{35}$ erg/s, and associated tmescales of about 1 h. These phenomena may explain the fast TeV variability found in some high-mass X-ray binaries such as Cygnus X-1, LS 5039 and LS I+61 303. Its investigation can help to obtain information on the properties of jets and clumpy winds.

Non-thermal radio emission from massive stars

Paula Benaglia

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Abstract. Radio emission has been detected from a significant number of massive, hot stars. Such stars present strong stellar winds that are expected to generate strong shocks, either in multiple systems where the winds collide, and in single stars. Non-thermal radio fluxes have been measured in dozens of early type stars. This emission is indicative of the presence of a population of relativistic electrons, presumably accelerated by shocks in the environs of the stars. The very same population is capable of producing gamma-rays by inverse Compton interactions with stellar photon fields. Hence, radio observations, especialy those of high angular resolution, are a unique tool to probe the relativistic particle content of the winds in massive stars. In this talk I will review the latest observational results of radio emission from stars and I will present some statistical analisys concerning OB and WR stars.

Non-thermal radio emission from colliding-wind binaries

Ronny Blomme

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Abstract. In colliding-wind binaries, shocks accelerate a fraction of the electrons up to relativistic speeds. These electrons then emit synchrotron radiation at radio wavelengths. Whether or not we detect this radiation depends on the size of the free-free absorption region in the stellar winds of both components. One expects long-period binaries to be detectable, but not the short-period ones. It was therefore surprising to find that Cyg OB2 No. 8A (P = 21.9 d) does show variability locked with orbital phase. To investigate this, we developed a model for the generation of relativistic electrons (including cooling and advection) and the radiative transfer of the synchrotron emission through the stellar wind. Using this model, we show that the synchrotron emitting region in Cyg OB2 No. 8A does indeed stick out far enough beyond the free-free absorption region to generate orbit-locked variability in the radio flux. This model can also be applied to other non-thermal emitters and will prove useful in interpreting observations from future surveys (such as COBRaS - the Cyg OB2 Radio Survey).

Relevant processes for high energy emission in microquasars harboring massive stars

Valentí Bosch-Ramon

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Abstract. Binary systems harboring powerful accelerators and massive stars are expected to be sites in which a plethora of complex non-thermal phenomena takes place. Hydrodynamical and magnetohydrodynamical outflows and their interactions, different mechanisms of acceleration, leptonic and hadronic radiative non-thermal processes, pair creation, etc., all of this can be relevant in the context of such a systems. In this regards, high-mass microquasars, in which relativistic motions, large energetic budget, particle transport, and extreme conditions take place, are very good candidates to study the complex physical interaction between the different components of these systems, as well as the components themselves, basically the massive star, the stellar wind, the jet, the non-thermal emission, and the compact object/accretion disk.

Cosmic Rays from Superbubbles?

Yousaf Butt

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Abstract. Superbubbles (SBs) are amongst the greatest injectors of energy into the Galaxy, and have been proposed to be the acceleration site of Galactic cosmic rays. They are thought to be powered by the fast stellar winds and powerful supernova explosions of massive stars in dense stellar clusters and associations. Observations of the SB 'DEM L192' in the neighboring Large Magellenic Cloud (LMC) galaxy show that it contains only about one-third the energy injected by its constituent stars via fast stellar winds and supernovae. It is not yet understood where the excess energy is going, thus, the so-called 'energy crisis'. We show here that it is very likely that a significant fraction of the unaccounted for energy is being taken up in accelerating cosmic rays, thus bolstering the argument for the SB origin of cosmic rays.

Anisotropic pair cascading in gamma-ray binaries

Benoît Cerutti

Laboratoire d'astrophysique de Grenoble, BP 53 F-38041 Grenoble Cedex 9, France

Abstract. Massive stars are thought to play a major role in the formation of the high energy radiation observed in gamma-ray binaries. The star provides a source of seed photons for inverse Compton scattering on very high energy electrons and pair production with very high energy gamma-rays. In LS 5039, a simple one zone leptonic model can describe the main spectral and temporal features at high energies. However, this model does not account for the flux detected by HESS at superior conjunction, where strong gamma-gamma absorption is expected. Emission from an electromagnetic cascade was proposed to solve this discrepancy. Previous works pointed out the importance of the stellar magnetic field and the primary source location in the development of an efficient cascade. We will report on our investigation of the generation of cascade radiation in LS 5039, taking into account the full complexity arising from anisotropic effects in pair creation and inverse Compton scattering.

High Energy Phenomena in Supergiant X-ray Binaries

Sylvain Chaty

Laboratoire AIM, CEA/DSM - CNRS - Université Paris Diderot, Irfu/Service d'Astrophysique, Centre de Saclay, Bât. 709 F-91191 Gif-sur-Yvette Cedex, France

Abstract. The INTEGRAL satellite has revealed a major population of supergiant High Mass X-ray Binaries in our Galaxy, revolutionizing our understanding of binary systems and their evolution. This population, constituted of a compact object orbiting around a massive supergiant star, exhibit unusual properties, either being extremely absorbed, or showing very short and intense flares. An intensive set of multi-wavelength observations has led us to reveal their nature, and to show that these systems are wind-fed accretors, closely related to massive star-forming regions. I will first describe the characteristics of these sources, before showing that this newly revealed population is likely linked to the evolution

of gamma-ray emitting massive stars with a compact companion.

The amazing HMXB population of the SMC

Malcolm Coe

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Abstract. The SMC represents an exciting opportunity to observe the direct results of high energy emission from High Mass X-ray Binaries (HMXBs). Though the SMC is 10 times further away than a typical galactic object, recent work has revealed a huge population of HMXBs in this galaxy. From the few objects already detected at TeV energies in our galaxy it seems likely that a reasonable percentage of such systems in the SMC should also be emitting at these energies. We present results XTE & Chandra which reveal the large extent of the population. In addition, correlated optical, IR & X-ray behaviour of these systems show the strong link between the high energy emission and the existence of a significant circumstellar disk around the young Be star companion in these systems.

Radio observations from massive binary systems

Sean Dougherty

Nartional Research council, Canada

Abstract. Massive stars are well-known sources of thermal radio emission that arises from their extended stellar wind envelopes. An increasing number of systems exhibit the properties of non-thermal emission. High-resolution radio observations over the past decade have unequivocally identified that in a number of systems the non-thermal radio emission arises in the region where the stellar winds of the massive companions collide. I will review the observations that led to this discovery, and highlight some more recent work.

Gamma-ray production mechanisms in massive binaries with a young pulsar

Guillaumen Dubus

Laboratoire d'Astrophysique de Grenoble, UMR 5571 Universit Joseph Fourier / CNRS, France

Abstract. I will review the formation of high energy radiation in the context of young pulsars orbiting massive stars such as PSR B1259−63. All detected gamma-ray binaries, systems where most of the radiative output occurs at energies above an MeV, could be powered by the dissipation of the pulsar rotational energy. The presence of a massive star brings strict geometrical and dynamical constraints on the physical processes at work. This can be used to probe pulsar

winds on hitherto inaccessible scales.

Diffusive Shock Acceleration: Nonlinear effects and Magnetic Field Amplification

Don Ellison

North Carolina State University, USA

Abstract. I will review the theory of diffusive shock acceleration (DSA) with an emphasis on the role of escaping particles. There is convincing evidence that supernova remnant shocks can produce cosmic rays (CRs) with high efficiency and the most likely acceleration mechanism is DSA. If the acceleration is efficient, nonlinear effects will be important and, in DSA, these effects include a modification of the shock structure from the backpressure of CRs, an amplification of the ambient magnetic field above simple compression, and the production of a sizable flux of the highest energy CRs which escape upstream. Since all of these processes are strongly coupled, semi-analytical or fully numerical techniques are required to describe the important nonlinear effects. I will discuss the possibility that similar processes occur in the winds of massive stars.

On the shape of the spectrum of cosmic-rays produced inside superbubbles

Gilles Ferrand

CEA/Irfu/SAp, L'Orme des Merisiers, bât 709, CEA Saclay, 91191 Gif sur Yvette Cédex, France

Abstract. In this work we investigate the shape of the spectrum of cosmic-ray (CR) protons produced inside superbubbles (SB), by the means of a simple semi-analytical model of CR production and transport embedded inside Monte-Carlo simulations of OB associations timelines. We consider regular acceleration (Fermi I process) at the shock front of supernova remnants, as well as stochastic re-acceleration (Fermi II process) and escape controlled by magnetic turbulence inside the SB. In this first attempt we limit ourselves to linear acceleration by strong shocks and neglect protons energy losses. We observe that CR spectra, although strongly intermittent, get a distinctive shape resulting from a competition between acceleration and escape: they are harder at the lowest energies (slope $s < 4$) and softer at the highest energies ($s > 4$). The momentum at which this spectral break occurs depends critically on the various SB parameters - but interestingly all their effects can be summarized by a single dimensionless parameter. For reasonable values of SB parameters, and especially for highly magnetized and turbulent SBs, very hard spectra can be obtained over an important range of CR energies, which has important implications on the

high-energy emission from these objects.

Monitoring LMXBs with the Faulkes Telescopes

Lewis Fraser

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Abstract. The Faulkes Telescope Project is an educational and research arm of the Las Cumbres Observatory Global Telescope Network (LCOGTN). It has two 2-metre robotic telescopes, located at Haleakala on Maui (FT North) and Siding Spring in Australia (FT South). It is planned for these telescopes to be complemented by a research network of eighteen 1-metre telescopes, along with an educational network of twenty-eight 0.4-metre telescopes, providing 24 hour coverage of both northern and southern hemispheres. We have been undertaking a monitoring project of 13 low-mass X-ray binaries (LMXBs) using FT North since early 2006. The introduction of FT South has allowed us to extend this to monitor a total of 30 LMXBs. With new instrumentation, we also intend to expand this monitoring to include both infrared wavelengths (z and y band) and spectroscopy.

The aims of the project are:

1. To identify transient outbursts in LMXBs. LMXBs may brighten in the optical/near-infrared for up to a month before X-ray detection. The behaviour of the optical rise is poorly understood, especially for black hole X-ray binaries. Catching outbursts from quiescence will allow us to examine this behaviour and alert the astronomical community to initiate multi-wavelength follow-up observations.

2. To study the variability in quiescence. Recent results have suggested that many processes may contribute to the quiescent optical emission, including emission from the jets in black hole systems (e.g. Russell et al. 2006). By monitoring the long-term variability of quiescent LMXBs, we will be able to provide constraints on the emission processes and the mass functions.

Molecular Clouds as a Probe of Highly Energetic Jets

Yasuo Fukui

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Abstract. We present new detections of linearly aligned molecular clouds that are likely created by interactions between the ISM and high-energy jets in the Galaxy. These clouds discovered based on the NANTEN CO survey are characterized by their good linear alignments and by helical distributions similar to extragalactic jets. Their lengths typically a few 100pc are much smaller than

the extragalactic jet but is significantly larger than that of the X ray jet in SS433.

TeV Gamma-ray Observations of Massive Star Systems with VERITAS

Jamie Holder

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Abstract. The VERITAS array of four imaging atmospheric Cherenkov telescopes, sited at the Whipple Observatory in Tucson, Arizona, has been observing the northern hemisphere TeV sky for the past two years. We will discuss the status and technical capabilities of the array, and summarize observations relating to massive star systems, including recent studies of the high-mass X-ray and TeV binary, LSI +61 303.

Suzaku spectroscopy of diffuse X-ray emission in the Galactic star forming region M17 and the Carina Nebula

Yoshiaki Hyodo

Kyoto University, Japan

Abstract. We present the Suzaku results of the diffuse X-ray emissions from M17 and the Carina Nebula. From the both regions, we obtained spatially resolved spectra with high signal-to-noise ratios. We clearly resolved emission lines from highly ionized O, Ne, Mg, and Fe for the first from the M17 region. The spectra were well reproduced by an optically-thin thermal plasma with a temperature of 0.25 keV. The temperature and chemical composition show no spatial variation within the studied field across 10 pc. Since the O/Ne ratio is consistent with the solar abundance, we argue that the emission is originated from stellar wind shocks. The diffuse emission from the Carina Nebula is also expressed by an optically-thin thermal plasma, but exhibit spatial variation the spectra. The emission in the west side of eta Carinae has a cool component of 0.2 keV, while that in the south side has a hotter component of 0.5 keV. The origin, therefore, may not be a stellar wind shock alone.

TeV gamma- and X-ray production in LS5039

Dmitry Khangulyan

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Abstract. LS5039 is up to now the best studied binary system in the VHE regime. The HESS observations established LS5039 to be a periodic TeV emitter with significant variation both in the energy flux and spectral shape. The observed gamma-ray properties of the system favor an inverse Compton origin of the VHE emission. It implies presence of VHE electrons which interact with target photons provided by the massive companion star. Here we study relevant leptonic processes (acceleration and radiation) in the system using available data in TeV and X-ray energy bands.

Fermi observations of the Large Magellanic Cloud

J. Knödlseder on behalf of the Fermi LAT collaboration

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Abstract. We report on observations of the Large Magellanic Cloud with the Fermi Gamma-Ray Space Telescope. The LMC is clearly detected with the Large Area Telescope (LAT) and for the first time the emission is spatially well resolved in gamma-rays. Our observations reveal that the bulk of the gamma-ray emission arises from the 30 Doradus region. We discuss this result in light of the massive star populations that are hosted in this area and address implications for cosmic-ray physics. We conclude by exploring the scientific potential of the ongoing Fermi observations on the study of high-energy phenomena in massive stars.

A long, hard look at massive X-ray binaries in the SMC

Vanessa McBride

University of Southampton, Highfield, SO17 1BJ, United Kingdom

Abstract. An AO-6 INTEGRAL key programme has provided the opportunity for the first in-depth simultaneous imaging study of the SMC across soft and hard X-rays. This enables monitoring of the large number of X-ray transients in our neighbouring galaxy, and the possibility of detecting for the first time a population of faint, persistent hard X-ray sources. Preliminary results from this 2 Ms observing programme will be presented.

Gamma-rays from star-forming regions: from SNOBs to Dark Accelerators

Thierry Montmerle

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Abstract. The first complete GeV map of the Milky Way, obtained in the late seventies by ESA's satellite COS-B, revealed a concentration of sources very close to the galactic plane. A number of them could be associated with "SNOBs" (i.e., supernova remnants in massive-star forming regions), but the modest angular

resolution of about 1 degree precluded any firm identification. The proposed mechanism was based of the interaction of high-intensity, locally accelerated cosmic rays (by supernova remnants but also by strong stellar winds), with the ambient, dense molecular clouds. Subsequently, new observations from space (GRO-EGRET: GeV) and from Cerekov telescopes (TeV) confirmed that massive star-forming regions are a class of gamma-ray sources, but in a number of cases no obvious energy source was found, hence the name "dark accelerators". I will review the present state of the art, and report first results of a search for ionizing interactions between cosmic rays and molecular clouds in the millimeter range.

Possible alternative counterparts to the SGR-like event towards the gamma-ray binary LS I +61 303

Alvaro J. Muñoz-Arjonilla et al.

University of Jaén, Spain

Abstract. We present the results of a deep radio imaging of the LS I +61 303 field based on a combined analysis of archival data obtained with the Very Large Array (VLA) at the 6 cm wavelength. In addition to this well known gamma-ray binary, we find several radio sources inside the error box of the SGR-like event recently observed towards it by the Swift satellite. None of them appears to display any special peculiarity which could indicate a different origin for the Swift flaring event other than LS I +61 303.

3-D Numerical Simulations of the Binary System PSR B1259−63/SS 2883 and High Energy Emission from the DISK-Wind interaction Region

Tsuguya Naito

Yamanashi Gakuin University, Japan

Abstract. PSR B1259−63/SS 2883 is a massive binary consisting of a 48 ms radio pulsar and a Be star with a circumstellar disk. The orbit is long (3.4 yr) and highly eccentric (e=0.87). The system is one of the three binaries from which persistent TeV gamma-rays have been detected. Radio, X-ray, and gamma-ray light curves all exhibit two peaks, one just prior to periastron and the other just after it. Given that the gas pressure in the Be disk is much higher than the ram pressure of the Be wind, it is important to take into account the interaction between the pulsar wind and the Be disk adequately.

As a first step toward the understanding of this complicated system, we study the high energy emission from the interaction region, based on the result from a 3-D Smoothed Particle Hydrodynamics (SPH) simulation, which takes into account only the gravitational interaction between the Be disk and the neutron star. We assume that the gas particles are ejected at a constant rate from the equatorial surface of the Be star, which is tilted in a direction consistent

with multi-waveband observations. We run the simulation until the Be disk is fully developed and starts a regular, orbital-phase dependent interaction with the neutron star. Then, using the simulation data, we first find the phase-dependent position where the ram pressure of the pulsar wind is expected to balance with the gas pressure of the Be disk, and take it as the location where shock waves are generated and particle acceleration takes place. Then, we calculate the synchrotron spectrum by accelerated elecrons in shocks on the side of the pulsar. We also calculate the spectrum produced by inverse Compton scattering with CMB photons, galactic background emission, and soft photons from the Be star. We find that the resulting fluxes in radio, X-ray, and gamma-ray bands show asymmetric double-peaked light curves similar to those observed.

In this contribution, we show movies/snapshots from the 3-D SPH simulation, which vividly show how the Be disk is disturbed when the pulsar passes through it, and present the resulting multi-wavelength light curves and spectra of high energy emission.

Stellar winds in high-mass x-ray binaries

Ignacio Negueruela

Universidad de Alicante, Spain

Abstract. High-mass X-ray binaries, containing a compact object, are wonderful laboratories to study the properties of stellar winds. The compact object can act as a probe to reveal the wind structure. On the other hand, its presence and the X-ray emission that it produces can have an impact on the same wind structure. I will discuss the information provided by these systems about the properties of the winds from high-mass stars. I will also discuss the limitations in our understanding of the physical mechanisms at work in high-mass x-ray binaries, especially in connection to the wind. Finally, I will focus on the main consequences that these unknowns may have on our understanding of the physics of very-high-energy massive sources.

H.E.S.S. observations of massive star clusters

Stefan Ohm on behalf of the H.E.S.S. collaboration

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Abstract. Star clusters are potential acceleration sites of very-high-energy particles since they host supernova remnants and pulsar wind nebulae. Additionally, in star clusters, particles can also be accelerated e.g. at the boundaries of wind-blown bubbles, in colliding wind zones in massive binary systems or in the framework of collective wind or wind/SN ejecta scenarios. These acceleration mechanisms and the detection of the young stellar cluster Westerlund 2 in very-high-energy (VHE) gamma-rays suggest Westerlund 1 as the foremost promising target in that category for VHE emission. Here we summarize H.E.S.S. obser-

vations of massive star clusters in general with special emphasis on the most massive star cluster in the galaxy, Westerlund 1.

Gamma-ray Variability from Wind Clumping in HMXRBs with Jets

Stan Owocki

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Abstract. In the subclass of high-mass X-ray binaries known as 'microquasars', relativistic hadrons in the jets launched by the compact object can interact with cold protons from the star's radiatively driven wind, producing pions that then quickly decay into gamma rays. Since the resulting gamma-ray emissivity depends on the target density, the detection of rapid variability in microquasars with GLAST and the new generation of Cherenkov imaging arrays could be used to probe the clumped structure of the stellar wind. We show here that the fluctuation in gamma rays can be modeled using a 'porosity length' formalism used to characterize clumping effects. For a thin jet and a moderate porosity length that is a few percent of the binary separation, we predict ca. 10% variation in the gamma-ray emission. Moreover, the illumination of individual large clump might result in isolated flares, as has been recently observed in some massive gamma-ray binaries.

Non-thermal emission from massive young stellar objects

Ross Parkin

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Abstract. While in the young stellar object (YSO) phase of their lives, massive stars drive bi-polar molecular outflows. These outflows produce beautiful, often hourglass shaped, cavities in their natal molecular cloud. The central star possesses a powerful stellar wind ($v \sim 2000$ km/s), and there may also be a dense equatorial disk wind ($v \sim 400$ km/s). These collide with the inner surface of the bi-polar cavity to produce hot ($T > 10000$ K) shocked plasma. The shocks are also possible sites for the acceleration of non-thermal particles to relativistic energies. Using hydrodynamical models of the wind interaction, coupled with calculations of the non-thermal energy spectrum, we explore the observable synchrotron and gamma-ray emission from these objects.

Models of the non-thermal emission from early-type binaries

Julian Pittard

The Universityof Leeds, Leeds, LS2 9JT U.K.

Abstract. The powerful wind-wind collision in massive star binaries creates a region of high temperature plasma and accelerates particles to relativistic energies. I will present hydrodynamical models of this interaction and modelling of the resulting non-thermal emission.

Massive stars and high-energy neutrinos

Gustavo E. Romero

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Abstract. Massive stars have been associated with the production of high-energy neutrinos since the early claims of detection of very high-energy gamma rays from Cygnus X-3 in the 1970s and early 1980s. Although such claims are now discredited, many thoretical models were developed predicting significant neutrino fluxes from binary systems with massive stars. With the discovery of microquasars, new, improved models appeared. The large neutrino telescopes currently under construction (IceCube, Antares) and the detection of gamma-ray sources of likely hadronic origin associated with massive binaries and star-forming regions make the prospects for high-energy neutrino astronomy quite promising. In this talk I will review the basic features of neutrino production in stellar systems and I will discuss the physical implications of a positive neutrino detection from such systems for our view of the stellar evolution and comsic ray origin.

Gamma-rays from massive protostars

Gustavo E. Romero, Co-authors: Anabella T. Araudo, Valentí, Bosch-Ramon and Josep M. Paredes

IAR, C.C. No. 5, 1894 Villa Elisa, Buenos Aires, Argentina

Abstract. Massive stars are formed in the dense cores of molecular clouds. The exact process of formation is not well understood, but there is increasing evidence supporting the fact that during their formation the protostars go through a phase of accretion/ejection of cloud material. The impact of the collimated thermal outflows in the interstellar or intra-cloud medium results in the formation of shocks that can accelerate particles up to relativistic energies. Synchrotron emission has been detected in several objects, which is a clear indication of the presence of such particles. In this talk we will discuss the possibility of using gamma-ray astronomy to get insights of the massive star formation process and we will present results of calculations of the spectral energy distributions that

are expected in some test cases.

Low-frequency radio observations of the MGRO J2019+37 complex

Juan R. Sánchez-Sutil et al.

University of Jaén, Spain

Abstract. We report a first account on the results of a wide-field mosaic obtained at 610 MHz (49 cm) with the Giant Metre-wave Radio Telescope (GMRT) in India covering the field of the TeV source MGRO J2019+37. A catalog of all radio sources detected is reported including both compact and extended objects. Their observational properties are described and presented. The possible connection of some of these sources with the MILAGRO gamma-ray emission will be assessed in future work.

Radio and X-ray observations of the probable new gamma-ray binary HESS J0632+057

Joanna Skilton

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Abstract. HESS J0632+057 is one of the only point-like, unidentified TeV sources in our Galaxy. The association of this source with the massive B0pe star MWC 148 has led to the suggestion that HESS J0632+057 could be a new gamma-ray binary system. Our recent X-ray observations with XMM-Newton have revealed a non-thermal, point-like source coincident with this star, further strengthening the identification of HESS J0632+057 as a high mass X-ray binary system. I will present new VLA and GMRT observations towards HESS J0632+057 which reveal a point-like source at the location of MWC 148, and discuss these data with the aim of characterising the radio properties of this object.

Non-thermal Radio Emission from A stars

Ian Stevens

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Abstract. We will discuss non-thermal radio emission from A stars. While the non-thermal emission from Wolf-Rayet and O and B stars has been much studied, the radio emission from A stars is much less understood. We will discuss multiwavelength observations of the magnetic chemically peculiar A0 star CU Virginis, which shows periodic non-thermal radio flares associated with stellar rotation. The radio emission is believed to be related to processes associated with the strong magnetic field. We will discuss new observations of this system, and what these observations tell us about the radio emission and the particle acceleration processes going on in the stellar magnetosphere of A stars, possibly with implications for understanding the processes in more massive stars.

Non-thermal radio emission from 'presumably' single O stars

Sven van Loo

University of Leeds, UK

Abstract. A number of hot stars have radio fluxes that deviate from a simple thermal spectrum. It is generally accepted that synchrotron radiation from relativistic particles accelerated in shocks, can account for this non-thermal radio emission. A fundamental question regarding non-thermal radio emission is its correlation with binarity. For Wolf-Rayet stars, the evolutionary descendents of O stars, this link is already well established, i.e. a binary component seems to be a pre-requisite for non-thermal radio emission. For binaries, the shocks needed for the acceleration of the electrons arise where two (or more) stellar winds collide. Roughly two thirds of the non-thermal O stars are confirmed binary or multiple systems. For the other stars, binarity has not been established. In these 'presumably' single stars, shocks are ubiquitous due to the instability of the radiative driving mechanism of the stellar wind. Recent theoretical studies however show that this embedded-shock model cannot be the source of the non-thermal emission and that the accelerating shocks arise where two stellar winds collide. This conclusion implies that all non-thermal emitting O stars are in a binary system. New observational evidence seems to corroborate this binary scenario.

XMM-Newton observations of the inner region of MGRO J2019+37

Víctor Zabalza

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Abstract. In order to better understand the puzzling extended TeV source MGROJ2019+37, we have performed a multiwavelength campaign from radio to x-ray covering most of its extent. Here we present an X-ray mosaic including a new observation and two archival observations performed by the X-ray observatory XMM-Newton. We discuss new point like and extended X-ray sources in the field that could help elucidate the physics behind MGRO J2019+37.

X-ray variability in massive X-ray binaries

Juan Antonio Zurita-Heras

AIM, CEA-Saclay, IRFU/Service d'Astrophysique, Bat. 709, L'Orme des Merisiers, 91191 Gif-sur-Yvette, France

Abstract. The INTEGRAL mission has discovered many new hard X-ray sources whose nature was determined through multi-wavelength observations. Among them, several massive X-ray binaries have been unveiled, increasing the number of supergiant/X-ray binaries by a factor 4 and changing the ratio of supergiant/Be X-ray binaries from 10/90% to 30/60%. These new systems showed similar X-ray observational properties to the previous known HMXB. However, some of these sources showed some particular features such as strong intrinsic obscuration of their soft X-ray emission and/or variability of their intensity reaching factors as high as 10^4 in a few hours. These features have broaden our view of these systems and can give hints of the physical conditions of the massive companion star (e.g. the strong stellar wind and its porosity). I will present results about the variability and spectral properties of HMXB obtained with INTEGRAL and XMM-Newton and what we learned from these observations.

Poster contributions

Studying the structure of the stellar wind in LS 5039

Valentí Bosch-Ramon

Max Planck Institut fur Kernphysik, Max-Planck-Institut fur Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg

Abstract. The binary LS 5039 is an X-ray non-thermal emitter that presents jet-like radio structures, being also one of the most misterious TeV sources in our Galaxy. The presence of an O-type star in this system implies that the non-thermal emitter must be embedded in a strong stellar wind, and the role of the latter could be relevant for the understanding of the high energy behavior of the source. In this work, we show that the lack of absorption features at soft X-rays in LS 5039 can constrain strongly the parameters that describe the wind, and ultimately the location of the non-thermal emitter.

Optical characterisation of the blue supergiant HD 3064 14, the optical counterpart to the peculiar X-ray transient IGR J11215-5952

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Abstract. The hard X-ray source IGR J11215-5952 is a peculiar transient, displaying very short (a few days) outbursts every 185 days. It is associated with the luminous B0.7Ia supergiant HD306414 and shows characteristics typical of wind accretors, leading to its association with the class of Supergiant Fast X-ray Transients. We present high-resolution spectroscopy of HD306414 around the time of the February 2007 X-ray outburst. Large variations in the shape of the H-alpha emission feature and the radial velocities of metallic lines are seen around the time of the X-ray emission. We show a preliminary analysis of the spectrum and discuss its implications in the context of different models proposed to explain this source.

The X-ray behavior of Supergiant Fast X-ray Transients

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Abstract. The data provided by the ESA INTEGRAL mission have revealed the presence of a huge new population of HMXRB sources. Among them, an important fraction belong to the fast-growing class of Supergiant Fast X-ray Transients (SFXT). This new class of binaries is characterized by very short outbursts with very fast rise times and typical durations of a few hours, staying in quiescent or below INTEGRAL/ISGRI sensitivity level most of the time. We

will present a summary of the main results until now from our on-going long-term monitoring campaign on these sources using the INTEGRAL mission.

e-EVN observations of high energy transients

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Abstract. The European VLBI Network is a powerful instrument to detect radio counterparts to high energy transients. With the e-VLBI developments the EVN is becoming more flexible as well to respond to ToO requests and produce immediate results. On my poster I will show the current status of the e-EVN and recent observational results.