Unified View of Stellar Winds in Massive X-ray Binaries

Team Leader: S. Martínez Núñez, University of Alicante, Spain.

Abstract

We propose to bring together specialists for winds from massive stars and observers of High-Mass X-ray Binary (HMXB) systems for two meetings at ISSI in order to review the state-of-the-art in observations and modeling and to develop a unified view on the physics of the stellar winds in these systems. The aim of the meetings is to define a general strategy on what can be learned from each other and also to explicitly advance towards a unified picture of massive star outflows in single stars and X-ray binaries.

1 Scientific rationale, goals and timeliness of the project

The birth, life, and death of massive stars ($M_{\text{initial}} > 10 M_\odot$) are deeply interwoven with the evolution of star clusters and galaxies. Massive stars generate most of the ultraviolet radiation of galaxies – the whole Universe was re-ionized with the help of the first (super)massive stars – and power their infrared luminosities. Massive star winds and final explosions as supernovae provide a significant input of mechanical and radiative energy into the interstellar medium, and play a crucial role in the evolution of star clusters and galaxies (Kudritzki 2002). Thus, massive stars are among the most important cosmic engines: they trigger the star formation and, together with low-mass stars, enrich the interstellar medium with the heavy elements but on short time scales, ultimately leading to formation of Earth-like planets and development of life. Among the bright X-ray sources in the sky a significant number consists of a compact object accreting from the wind of such massive stars. These winds are fast, with typical terminal velocities up to $2500 \text{ km s}^{-1}$, dense, with mass-loss rates $\dot{M} > 10^{-7} M_\odot \text{ yr}^{-1}$, and driven by line scattering of the star's intense continuum radiation field. Good examples are Cyg X-1/HDE 226868, the first detected stellar-mass black hole, and Vela X-1, one of the most important accreting neutron star binaries. While the basic picture has been established for decades, many details are still debated. This proposal aims to develop a shared view of the physics of stellar winds of massive stars in orbit with an accreting compact object.

1.1 Current picture of stellar wind accretion

The first quantitative description of line-driving stellar wind was given in the seminal paper by Castor et al. (1975), which assumed a stationary, homogeneous, and spherically symmetric outflow. Linear stability analyses (e.g., Owocki & Rybicki 1984), however, showed that the line-driving of hot star winds is in fact unstable to velocity perturbations on spatial scales near and below the Sobolev length (as already suggested by Lucy & Solomon (1970)). 1-D and 2-D time-dependent numerical radiation-hydrodynamical simulations (Owocki et al. 1988; Feldmeier et al. 1997a,b; Dessart & Owocki 2005), further showed that the non-linear growth of this strong line-deshadowing instability (LDI) leads to high-speed rarefactions that steepen into strong shocks, whereby most material is compressed into spatially narrow 'clumps' (or shells in 1-D simulations) separated by large regions of much lower densities. This characteristic structure in density and velocity is the theoretical basis for our current understanding and interpretation of wind clumping, and is supported by numerous observational and diagnostic studies in many different wavebands (see Hamann et al. 2008; Sundqvist et al. 2011, for comprehensive overviews).

In optical and UV data of isolated massive stars this evidence is seen in various, independent studies, as for example, Lucy (1982) postulated the existence of non-monotonic velocity fields in the winds. Meanwhile Hillier (1991) inferred the existence of wind clumping from the shape of electron-scattering wings in emission lines of Wolf-Rayet (WR) stars. Stochastic variable structures in the He II λ4686 Å emission line in an O-supergiant were found by Eversberg et al. (1998) and explained as excess emission from the wind clumps. Markova et al. (2005) investigated the line-profile variability of Hα for a large sample of O-type supergiants. They concluded that the observed variability can be explained by a wind model consisting of coherent or broken shells. Lépine & Moffat (1999, 2008) presented direct spectroscopic evidence of clumping in O and WR star winds. Prinja & Massa (2010) established spectroscopic signatures of the wide-spread existence of wind clumping in B supergiants.
Moreover, the presence of numerous strong, embedded wind shocks (EWS) distributed throughout the wind in such LDI simulations provides a generally accepted explanation (Feldmeier et al. (1997a,b)) for the strong soft X-ray emission typically observed from “normal” (putatively single, non-magnetic) OB-stars by orbiting telescopes like XMM-Newton and Chandra (see Güdel & Nazé (2009), for a review), as well as for the general lack of significant observed time-variability.

The inhomogeneity affects stellar wind diagnostics. Waldron & Cassinelli (2001) proposed that a clumpy wind structure may help to explain the observed X-ray emission line profiles in the spectra of O-supergiants. A theory of X-ray transfer in clumped winds that accounts for clumps of any shapes and optical depths was developed by Feldmeier et al. (2003) and Oskinova et al. (2004). Accounting for wind clumping allows to consistently model the UV/optical and the X-ray spectra of O-stars (Oskinova et al. 2006).

Presently, clumping in first approximation (“microclumping”) is taken into account in all up-to-date stellar wind codes. This approximation assumes that clumps are optically thin and that the interclump medium is void. Microclumping leads to smaller empirical mass-loss rates when using diagnostics that depend on processes scaling with density squared ($\rho^2$), such as Hα and other emission lines, or radio free-free emission (Hillier 1991; Hamann & Koesterke 1998). Oskinova et al. (2007) found that allowing for clumps of arbitrary optical depth (“macroclumping”) must be included in analysis of stellar spectra to yield empirically correct mass-loss rates. Now the macroclumping is included in full 3D radiative-transfer models of stellar winds (Šurlan et al. 2012).

### 1.2 Observational facts of structured winds in massive X-ray binaries

The observational evidence of clumped winds comes also from the observation of accretion phenomena in High Mass X-ray binaries (HMXBs) where a compact object (a black hole or a neutron star) orbits a high mass star. Sako et al. (2003) reviewed spectroscopic results obtained by X-ray observatories for several wind-fed HMXBs. They concluded that the observed spectra can be explained only as originating in a clumped stellar wind where cool dense clumps are embedded in rarefied photoionized gas. van der Meer et al. (2005) studied the X-ray light curve and spectra of the HMXB 4U 1700−37. They showed that the feeding of the NS by a strongly clumped stellar wind is consistent with the observed stochastic variability.

in’t Zand (2005) proposed that the flaring behavior of supergiant fast X-ray transients (SFXT) can be explained by the accretion of wind blobs. This suggestion was corroborated by the studies of hard X-ray flares and quiescent emission of SFXT systems by Walter & Zurita Heras (2007). Negueruela et al. (2008) postulated that the different flaring behavior can be an immediate consequence of diverse orbital geometries, while Sidoli et al. (2007) suggested the possibility of a non-spherical geometry for the outflowing clumpy supergiant wind.

Kreykenbohm et al. (2008) studied the temporal variability of Vela X-1. They interpreted flares and off states as being due to a strongly structured wind of the optical companion. Ducci et al. (2009) developed a phenomenological stellar wind model for OB supergiants to investigate the effects of accretion from a clumpy wind on the luminosity and variability properties of high-mass X-ray binaries. Sidoli et al. (2010) suggested that the X-ray variability of the HMXB IGR J08408−4503 may be explained by large-scale wind structures. Fürst et al. (2010) find a log-normal distribution of clumps in Vela X-1 with clump mass estimates in line with Negueruela et al. (2008) or Walter & Zurita Heras (2007). For Cyg X-1, Chandra-HETGS observations support the presence of cold dense clumps in the stellar wind (Miškovičová et al. 2011). The fast variability of prominent fluorescence lines in GX 301-2 indicate that a strongly structured wind is present throughout the system (Fürst et al. 2011).

Oskinova et al. (2012) used results from time-dependent hydrodynamical models of the line-driven wind to derive the time-dependent accretion rate onto a compact object in the Bondi-Hoyle-Lyttleton approximation. The model predicts a large scale X-ray variability, up to eight orders of magnitude, on relatively short timescales. This is not observed, underlining the need to treat the accretion process in more detail.

In conclusion, although the presence of structured (clumped) winds in massive stars is well established, there is still considerable uncertainty in the physical properties of those clumps and the mechanisms by which this wind feeds the compact object (used as in situ probe of the wind) in binaries.
1.3 Goals of the project

- Collect and review observational phenomena which might be explained by wind clumping: X-ray flux variability, changes in fluorescence lines, etc.
- Review the state of knowledge about wind models and their predictions for observed phenomena. E.g., the role of instabilities in wind accretion versus the variations caused by clumping.
- Advance towards unified picture of massive star outflows in single stars and X-ray binaries, updating, if necessary, the classical papers.
- Produce a consensus view allowing to describe all/most observed properties of specific sources, e.g., Vela X-1 or 4U 1700–37.

1.4 Timeliness of the project

As discussed in the previous sections, both theoretical models and the catalogue of high-quality observations have progressed to a point that allows for detailed comparison between models and data in HMXB, but this is still done rather infrequently. The situation is ripe for increased collaboration across wavelength bands and fields of study, exactly what the proposed project is aiming at.

2 Expected Output

- Publications on detailed comparison between existing models and data for selected sources.
- Updated models of winds from massive stars and especially in HMXB.
- Review publication on unified picture derived during the project.

3 List of confirmed participants

The proposing team includes nine experts in high quality observations of high-mass X-ray binaries at high energies and other wavelengths, as well as accretion mechanisms in X-ray binary systems and three specialists for winds of massive stars, both for single stars and those in binary systems. All are committed to participating in the project. A short CV for each team member is appended.

<table>
<thead>
<tr>
<th>Name</th>
<th>Expertise</th>
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</thead>
<tbody>
<tr>
<td>Pere Blay</td>
<td>Multi-wavelength observations (radio, IR, optical, UV, X-rays &amp; γ-rays)</td>
</tr>
<tr>
<td>Maurizio Falanga†</td>
<td>Theory of accretion onto neutron stars</td>
</tr>
<tr>
<td>Felix Fürst</td>
<td>X-ray &amp; γ-ray observations, orbital &amp; long-term variability</td>
</tr>
<tr>
<td>Peter Kretschmar</td>
<td>X-ray &amp; γ-ray observations, accretion mechanisms, variability</td>
</tr>
<tr>
<td>Ingo Kreykenbohm</td>
<td>X-ray &amp; γ-ray observations, accretion mechanisms, flares &amp; off-states</td>
</tr>
<tr>
<td>Silvia Martínez Núñez</td>
<td>near-IR, X-ray &amp; γ-ray observations</td>
</tr>
<tr>
<td>Lidia Oskinova</td>
<td>Stellar winds, models, radiative transfer, accretion</td>
</tr>
<tr>
<td>Joachim Puls</td>
<td>Radiat. transfer, hydrodynamics, NLTE model atmospheres, quantit. spectroscopy</td>
</tr>
<tr>
<td>Lara Sidoli</td>
<td>X-ray spectroscopy, variability of the wind absorption, X-ray flares</td>
</tr>
<tr>
<td>Jon O. Sundqvist</td>
<td>Stellar winds, models, quantitative spectroscopy</td>
</tr>
<tr>
<td>José M. Torrejón</td>
<td>multi-band spectroscopy, plasma diagnostics</td>
</tr>
<tr>
<td>Jörn Wilms</td>
<td>X-ray &amp; γ-ray observations, X-ray spectroscopy, radiation processes</td>
</tr>
</tbody>
</table>

† Self-supported as ‘External Expert’

No International Teams dedicated to this topic have been organized in the past at ISSI, possibly because the gap between the (high-energy) observers of HMXB systems and researchers of winds from massive stars was too wide to be bridged by observations and models. This is exactly what we try address in this project. As briefly indicated in the table above, the observers’ expertise covers a range of observational features, both in the spectral and in the timing domain, while the wind specialists bring the necessary knowledge about wind properties and state-of-the-art models to ensure fruitful discussions.

In case of acceptance of the proposal, the team will take advantage of the Young Scientist scheme and add 20% young scientists, working on this subject. The team leader, in consultation with the members, will identify the young scientists and invite them to the team meetings.
4 Schedule of the Project

We foresee two one-week meetings, spaced by about one year, with the first meeting in early 2013. Experience with other ISSI team meetings for some of us shows that this spacing allows to develop new ideas and collaborative efforts at the first meeting which can then be developed for the second, including first publications. All team members have confirmed their participation at both meetings.

The first meeting will focus on the following topics (leading team members in alphabetical order, where applicable):

- Review of available models, predictions and limitations (Oskinova, Puls, Sundqvist).
- Review of selected, high-quality observations and observable properties, e.g.:
  - X-ray spectroscopy of wind-accretors (Sidoli, Torrejón, Wilms)
  - Variability of the wind absorption (Kretschmar, Martínez Núñez, Sidoli)
  - X-ray flares and dips (Kretschmar, Kreykenbohm, Martínez Núñez, Sidoli)
  - Statistical studies of wind accretor variability (Fürst, Kreykenbohm)
  - Results from multiwavelength studies (Blay)
- Description of selected sources and their properties within existing models and detailed comparison of results from different approaches (Oskinova, Puls, Sundqvist).
- Identification of specific and doable improvements to the existing models.
- Identification of further observational studies and new observations to test the current models.
- Definition of structure of review paper and responsible authors for specific sections.

Results from this first comparison are expected to lead to specific publications and to drive improvements of the existing model calculations in the time frame between the two meetings. The planned review paper will be drafted, based on the results of the first meeting and remaining questions identified and discussed in emails and teleconferences between team members.

The second meeting, which will happen in early 2014 will then concentrate on:

- Review of improved models and changes (Oskinova, Puls, Sundqvist).
- Review of new observational studies, focussing on specific model tests (other team members, as applicable).
- Conclusion on state-of-the-art in understanding winds in HMXB and avenues for future work.
- Discussion of review draft and joint work towards submission – a significant fraction of the meeting time is to be dedicated to this effort.

5 Added value of ISSI

Observers of High-Mass X-ray Binaries and specialists on the winds of massive stars and their theory tend to coincide only occasionally at scientific conferences and workshops. The intense and productive exchanges, both during and outside working hours, typical for ISSI team meetings are expected to foster a new qualitative level of collaboration within this team and thus help to bridge this gap.

The combination of a working space away from routine distractions, but with the full access to literature and scientific resources allows for detailed result comparison and critical discussion of results in a way difficult to achieve at scientific workshops or in individual meetings between participants.

Finally, the central location in Europe and the provision of accommodation greatly simplify travel arrangements for all members.

6 Required Facilities

The project will require and make full use of the standard facilities available at ISSI, i.e., meeting and break-out rooms, access to the internet and the scientific literature, and a projector.
7 Financial support requested from ISSI

We request funding support for living expenses of team members while residing in Bern, and for travel costs of the team leader. Travel costs to ISSI of the other team members will be covered by resources at their home institutes.

References

8  Contact Information for Team Members

<table>
<thead>
<tr>
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Curriculum Vitae — Pere Blay

Personal Information

Name: Pere Blay
Affiliation: Image Processing Laboratory, University of Valencia
Address: PO BOX 22085, E-46071 Valencia, Spain
Tel. +34 96 35 43608
Fax. +34 96 35 43261

Education

2006 PhD in Physics, at the University of Valencia, on the “Multiwavelength analysis of two peculiar High-Mass X-Ray Binary systems: 4U 2206+54 and SAX J2103.5+4545. New insights from INTEGRAL”
1992–1997 University diploma in theoretical physics

Employment

2002– System administrator of the GACE/IPL data processing center, University of Valencia
1998–2001 Lead of the LEGRI Science Operations Centre, University of Valencia

Research Interests

Multiwavelength studies of accreting X-ray pulsars, mainly BeX systems. Observational aspects of the physics behind the flow of matter from the surface of the massive companion onto the compact object in High-Mass X-Ray Binary Systems. Technics of processing and analysis of data from astronomical sources.

Publications

48 publications (22 as first author) 21 of them refereed (8 as first author). 44 lectures and/or contributions to workshops/conferences, 34 of which of international character. 1 invited talk.
Felix Fürst

Curriculum vitae

Education

12/2011 PhD in astrophysics (Dr. rer. nat.), Dr. Karl-Remeis Observatory & ECAP, Bamberg, Uni Erlangen-Nürnberg, Germany.
Title: “Galactic Windmills: Spectroscopical and Timing studies of three X-ray binaries”

05/2009–11/2009 stay in the US, University of California, San Diego (UCSD) & Goddard Space Flight Center (GSFC), Greenbelt.
per DAAD funding for PhD students

10/2008 diploma in physics, grade: 1.27.
title of thesis “Investigations of the SAA and the long-time behavior of Vela X-1”

09/2005–12/2005 studies abroad, University Joensuu, Finland.
per Erasmus programme


Employment history

starting 06/2012 researcher with the NuSTAR-team, Caltech, Pasadena, CA.

10/2008–12/2012 scientific employee, Dr. Karl-Remeis Observatory, Bamberg.
analyzing data of the X-ray satellite XMM-Newton
as well as analysing and extracting data from the satellites RXTE, Suzaku, INTEGRAL, Swift and RHESSI

lecture for undergrad students: “Introduction to design scientific texts with L\TeX”

Research interests

My main research interest lies in the analysis and understanding of accreting binary systems. Utilizing all modern X-ray telescopes, I investigate the behavior of matter under the influence of strong gravitation, magnetic fields, and radiation. By using tracers like the variability of fluorescence lines and variations in X-ray flux the structure and physical state of the accreted matter becomes visible. As a secondary research interest I investigate the radiation environment in low-Earth orbits, its temporal evolution and its connection to solar activity and variability in Earth’s magnetic field.

Publications

9 refereed papers (4 as first author), 13 non-refereed publications
Curriculum Vitae — Peter Kretschmar

Education and Employment History

Oct 2009 – Integral Mission Manager
Jan 2007 – Integral Science Operations Manager
Apr 1996 Ph.D. in Physics and Astronomy, Univ. Tübingen
"Hochenergieröntgenspektren der akkretierenden Röntgenpulsare Vela X-1 und A 0535+26" (Hard X-ray spectra of the accreting X-ray pulsars Vela X-1 and A 0535+26)
May 1992 University diploma in physics (Dipl. phys.)
"Kalibration von Hochenergieröntgendetektoren am Spektrum des Crab-Nebels und Untersuchungen am Röntgenpulsar A 0535+26" (Calibration of hard X-ray detectors using the spectrum of the Crab Nebula and studies of the X-ray pulsar A 0535+26)
Jan 1984 – Mar 1985 Military service
Oct 1983 Physics studies, Eberhard-Karls-Universität Tübingen
May 1983 Abitur, Gesamtschule Tübingen

Research Interests

High-energy observations of accreting X-ray pulsars and the comprehension of these systems at all scales, from the systems as a whole and their accretion mechanisms down to details of the radiation processes in the accretion column. High-energy radiation processes. High-energy satellite instrumentation.

Memberships

International Astronomical Union; European Astronomical Society; Swiss Society for Astrophysics and Astronomy

Publications

78 refereed publications, 167 non-refereed contributions.
Dr. Ingo Kreykenbohm: Curriculum Vitae

Name
Ingo Kreykenbohm

Date of Birth
June 11, 1972

Place of Birth
Weingarten, Germany

Nationality
German

Development

01.2008–
eRosita NRTA software responsible at the Dr. Remeis Observatory, Bamberg, Germany
Instrument specialist for SPI onboard INTEGRAL at the Integral Science Data Centre, Geneva, Switzerland
09.2004
PhD
06.2004
PhD Defense
11.1998–06.2004
PhD student, thesis: “X-ray spectra of highly magnetized neutron stars in binary systems”
01.1998–10.1998
Military Service (German Air Force)
Scientific co-worker at the IAAT
09.1997
Diploma
07.1996–12.2007
Institute for Astronomy & Astrophysics (IAAT), Tübingen, Germany
10.1991
Eberhard-Karls Universität Tübingen, major: physics
06.1991
Abitur (Highschool Graduation)
1982–1991
Highschool Balingen
1978–1982
elementary school Dormettingen/Dotternhausen

Awards

Ehrenmedaille der Bundeswehr (medal of honor of the German Army)

Publications

• refereed publications: 70
• non-refereed publications: 145
Curriculum Vitae — Silvia Martínez Núñez

Education


Employment history

Since 2007/11/01: Post-doc researcher at Alicante University, Alicante, Spain.

2004/06/01 - 2007/06/01: non-permanent position (researcher) at the Astrophysics and Space Research Group of Valencia University, Valencia, Spain.

Research Interests

My main field of research is Galactic High Mass X-ray binaries, interpretation and data analysis of observations in the X-ray domain using INTEGRAL and XMM-Newton data and in the near-IR domain using William Herschell Telescope and the Canaries Great Telescope. As a researcher in Valencia University, I was member of the X-ray monitor on-board INTEGRAL (JEM-X) scientific software team as well as the role of instrument representative at ISDC during the verification phase of INTEGRAL mission. Working at the Alicante University, I’m working on multiwavelength approach of High Mass X-ray binaries and in particular in the study of the stellar wind of the supergiant X-ray binary system Vela X-1 using XMM-Newton.

Accepted proposals

Co-I of several accepted proposal for observations with INTEGRAL. PI of several accepted proposal for observations with William Herschel Telescope and the Canaries Great Telescope.

Publications

Invited seminar at ESAC (02/03/2012).

14 refereed papers.

20 international meetings contributions.
Curriculum Vitae

Personal data

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Office address: Institut für Physik & Astronomie, Universität Potsdam
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Education

Ph.D. in Astronomy, St.-Petersburg University  March 2001
M.S. in Astronomy, St.-Petersburg University  July 1990

Positions Held

Jan 2002 – present  Scientific employee: Universität Potsdam
Jan 2000 – Dec 2001  Research Assistant: University of Glasgow
Sep 1998 – Dec 1999  Royal Society Fellow, University of Glasgow

Research Interests

Stellar winds; Radiative transfer; Massive Stars; X-rays: stars; Accretion; X-rays: binaries;

Community service

Time allocation committees for ESA & NASA
NASA, ESA press-releases

Teaching Experience: Lecture Courses

Quantum mechanics; X-ray astronomy; High-energy processes in astrophysics; Astrophysics of gaseous nebulae;

Publications

47 referred publications; 18 as first author
Curriculum Vitae – Joachim Puls

Personal Data

born Nov. 6th, 1957, in Bremen, Federal Republic of Germany
married with Maren, nee Klose, two children

Education

1964 – 1977 School, final exam Abitur
1977 – 1979 Military service
1979 – 1985 Study of physics at Ludwig-Maximilians-University, Munich (LMU)
May 1985 Diploma in physics, “summa cum laude”
   Subject of Diploma Thesis: “Radiation transfer
   in expanding atmospheres of hot stars”

Scientific Profession

1985 – 1986 Research scientist at the University Observatory Munich
1986 – 1987 Collaboration on the DFG (German Research Organisation)
   project “Radiatively driven winds of hot stars”,
May 1987 Promotion to Dr. rer. nat. by the physics faculty,
   LMU Munich, “summa cum laude”
   Subject of Thesis: “Theory of radiation driven winds of hot stars:
   The influence of ‘multi–line’ effects”
1987 – 1990 Collaboration on the DFG project “Theory of Cosmic Plasmas”,
Sept. 1990 “Scientific Assistant” at LMU Munich
July 1994 Habilitation to Dr. rer. nat. habil. by the physics faculty, LMU Munich
   Subject of Habilitation thesis: “Winds of hot massive stars–
   Theoretical Approaches and Diagnostic Methods”
March 1995 Privatdozent at LMU Munich (comparable to Assistant Professor)
since 03/96 Permanent position at University Observatory.
   Present status “Akademischer Oberrat”

Affiliations

since 2003 OC member of the “IAU Working Group on Massive Stars”
since 2006 OC member of IAU Commission 36, “Theory of Stellar Atmospheres”
since 2009 Vice-president of IAU Commission 36
since 2010 Chair of “IAU Working Group on Massive Stars”

Research interests
Radiative transfer, radiation hydrodynamics, NLTE model atmospheres, and quantitative spectroscopy of massive stars.

Publications
Two reviews on hot star winds in AARv and A&ARv, 12 invited reviews at international conferences, 100 publications in refereed journals, with 4200 citations and an h-index of 39. Numerous non-refereed publications.
Curriculum Vitae — Lara Sidoli

Education


Laurea in Physics - University of Milan, July 1995 (mark 110/110)

Employment History

Since 2008, May, 5: Staff researcher (permanent position) at INAF-IASF, Milan, Italy

2006/07/02 - 2008/05/04: non-permanent position (researcher) at INAF-IASF, Milan

2001/07/02 - 2006/07/01: non-permanent position (researcher) at IFC/C.N.R., Milan

1999-2001: ESA Research Fellow at the Astrophysics Division SSD-ESA/ESTEC, The Netherlands, under the supervision of Dr. Arvind N. Parmar.

Research Interests

My main field of research is Galactic X–ray binaries, interpretation and data analysis of observations in the X–ray domain of Galactic low mass and high mass x-ray binaries. As PhD student, I worked on the BeppoSAX satellite mapping (with the narrow field instruments) of the Galactic Center region (plerions, supernova remnants, diffuse X-ray emission from molecular clouds, low mass x-ray binaries, SgrA*). As ESA Research Fellow, I mainly worked on BeppoSAX and XMM-Newton data of low mass x-ray binaries, globular clusters bright X–ray sources, X–ray dippers, discovering Narrow X-ray Absorption Lines in 2 LMXBs (GX13+1, X1658-298). Working at IFC/CNR and IASF/INAF (Milan), I joined the INTEGRAL Team, mainly working on X-ray data of high mass X–ray binaries and, more recently, supergiant fast x-ray transients. Since May 2008 I obtained a permanent position at IASF/INAF (Milan), and now I am mainly working on high mass X–ray binaries (Supergiant Fast X–ray Transients) and very faint x-ray transients.

Accepted Proposals

PI of several accepted proposal for observations with BeppoSAX, XMM-Newton, Suzaku, Swift and INTEGRAL.

Publications and Invited Talks


65 refereed papers (35 as first author).

115 non refereed papers (including non-refereed proceedings and ATels).

These papers collect a total of 1264 citations (SAO/NASA ADS).
Curriculum Vitae — Jon Olof Sundqvist

Personal information

Name: Dr. Jon Olof Sundqvist  
Date of birth: 12. September 1980  
Place of birth: Östersund, Sweden  
Civil status: Single  
Home address: 10 Cordrey Road, 19713 Newark DE, USA  
Current employment: Post-doctoral Researcher in stellar astrophysics at the University of Delaware, USA

Education and Scientific Employment

Sep. 2000 - Jun. 2001  Base year of natural science degree, University of Gävle, Sweden  
Aug.2002 - Dec.2002  Exchange student at Eastern Connecticut State University, USA  
Sep. 2003 - Aug.2007  Master of Science degree, majoring in physics and astrophysics, University of Uppsala, Sweden  
Thesis title: ’Modeling stellar Mg I emission lines at 12 µm’  
Sep. 2007 - Sep.2010  PhD in astrophysics, Ludwig Maximilian University, Munich, Germany. Thesis title: ‘Quantitative spectroscopy of stellar atmospheres and clumped hot star winds - new methods and first results for deriving mass-loss rates’  
Okt. 2010 - Feb.2011  Wissenschaftlicher Mitarbeiter, Ludwig Maximilian University, Munich, Department of physics and astrophysics  
Feb. 2011 - Present  Post-doctoral researcher, University of Delaware, Department of physics and astronomy

Selected Publication list


J.O. Sundqvist et al., Mass loss from inhomogeneous hot star winds II. Constraints from a combined optical/UV study, Astronomy & Astrophysics, 2011, 528, 64


In total 6 refereed publications published, 5 of these as first author, and 4 conference contributions.
Curriculum Vitae — José Miguel Torrejón

Education and Employment History

- 2008: Visiting Scientist MIT Kavli Institute for Astrophysics and Space Research
- 2003–: Senior Lecturer of Physics and Astronomy, Polytechnic School, University of Alicante
- 2001–2002: Lecturer of Physics and Astronomy, Polytechnic School, University of Alicante
- 1997–2000: Associate lecturer of Physics, Polytechnic School, University of Alicante
- 1997: PhD in Physics, University of Valencia, "Physical properties of Be stars in open clusters" (Summa Cum Laude)
- 1996–1997: Associate lecturer of Astronomy, University of Valencia
- 1992: University diploma in Physics, "Simultaneous uvbyβ photometry and Hα spectroscopy of Be stars in open clusters".
- 1991: Researcher "Los Molinos" Observatory
- 1990: Degree in Physics, Universidad de Valencia

Research interests


Actively involved in ESA's INTEGRAL gamma ray telescope mission from the phase A studies to the present. Member of the "X-ray binaries task group" of the Advanced Telescope for High Energy Astrophysics (ATHENA), proposed as L class mission to ESA. PI of three large research projects funded by the Spanish National Space Plan (PNE) since 2000. PI of several successful observing proposals in world class observatories, including NASA's Chandra X-ray observatory.

Publications

Invited review talk at COSPAR 39 Scientific Assembly.
30 refereed papers, 18 of them as a first or second author.
More than 40 non-refereed papers, including international conference proceedings and ATel communications.
Jörn Wilms: Curriculum Vitae

Research Interests
Observational and theoretical studies of accreting Black Holes, Neutron Stars, and Active Galactic Nuclei; Astrophysical Radiation Processes; High Energy Astrophysical Satellite Instrumentation

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Germany

Vita
07.2006– Professor (W2) for Astronomy and Astrophysics, University of Erlangen-Nürnberg
Joint director of Remeis-Observatory, Member of board of directors of Erlangen Centre for Astroparticle Physics
01.2004–06.2006 Lecturer in Astronomy and Astrophysics, University of Warwick, Coventry, UK
2003 Heisenberg Fellowship of the DFG (declined)
04.12.2002 Habilitation in Astronomy and Astrophysics
01.1999–01.2004 Wissenschaftlicher Assistent, IAA Tübingen
04.1998–12.1998 Researcher, IAA Tübingen
04.1998 Dr. rer. nat. in physics
X-rays from Galactic Black Holes – Theory and Observation
05.1996–03.1998 Research Assistant, IAA Tübingen
04.1996 University diploma in physics (Dipl. phys.)
Reprocessing of X-rays in galactic and extragalactic X-ray Sources
06.1993–07.1994 University of Colorado, Boulder
exchange graduate student in astrophysics
10.1990–04.1996 Eberhard-Karls-Universität Tübingen
1991–1996 Deutsche Studienstiftung Fellowship for academic excellence
04.1988 Abitur Schloßgymnasium Kirchheim/Teck

Memberships / Positions

Publications
128 refereed publications, more than 200 non-refereed publications.