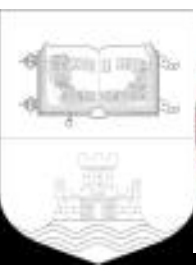




# AstroMundus

ERASMUS MUNDUS JOINT MASTERS COURSE  
in Astronomy and Astrophysics

**Dragana Ilic**  
(Faculty of Mathematics, University of Belgrade)  
on behalf of the Astromundus Consortium



## Joint Master Degree of 5 partners:

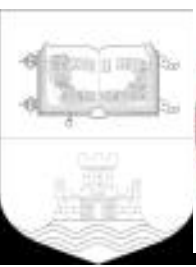


- University of Innsbruck (Coordinating institution)
- University of Belgrade
- University of Göttingen
- University of Padova
- University of Rome Tor Vergata

# Astromundus are people...



Meeting of Edition 1 and 2 students in 2012



## Consortium: Partners



- University of Innsbruck (Coordinating institution)
- University of Belgrade
- University of Göttingen
- University of Padova
- University of Rome Tor Vergata



# Consortium: Associates



- Astronomical Observatory Belgrade
- INAF = Istituto Nazionale di Astrofisica
  - Astronomical Observatory of Padova (INAF-OAPd)
  - Astronomical Observatory of Rome (INAF-OAR)
- Gran Sasso Science Institute
- Max Planck Institute for Solar System Research (MPS)





# Astromundus Objectives

- **Main objective:** provide top-ranked students with excellent background in astrophysics
- But also:
  - introduce students to the world of modern astrophysical research
  - application of modern techniques
- **number of students ~120 (8 Editions)**
  - **Exchange of scholars (among partners, but also from other institutions)**



# Study Path

Institution	1st semester	2nd semester	3rd semester	4th semester
Innsbruck	x			x
Padova		x		x
Rome		x	x	x
Göttingen			x	x
Belgrade			x	x

**All students are together in the first semester!**

- students are being brought to the same level
- necessary for the following, more specialised courses in the following semesters
- bringing the students of one edition together, so that they are really acting as a group

**We can recommend this!**



This is to certify, that  
 in view of the Addendum 1 of the Consortium Agreement of Jan 22<sup>nd</sup> 2010  
 between the members of the AstroMundus Consortium

born [redacted] in [redacted]  
 after successful completion of the

Erasmus Mundus Joint Master Program in Astrophysics on [redacted]  
 leading to a

## Master of Science in Astrophysics

has been awarded the following Academic Degree

Master of Science (MSc)  
 Notification from [redacted] in  
 accordance with § 87, sect. 1 of the  
 Universities Act 2002

Laurea Magistrale in Astronomia Classe LM-58  
 delle Lauree Magistrali in Scienze dell'Universo,  
 (D.M. 16.3.2007)

Study program: Erasmus Mundus Joint European Masters  
 Studies in Astrophysics - Astromundus, officially recognized  
 on 06.04.2012 under the number 612-00-02270/2011-  
 04, for obtaining the academic title Master of Astrophysics

Студијски програм: Еразмус Мундус заједничке  
 европске мастер академске студије из астрофизике  
 – Астрофизика, акредитован дана 06.04.2012 год,  
 под бројем 612-00-02270/2011-04, за стицање звања  
 мастер астрофизичар.

Georg-August-Universität Göttingen  
 Consecutive Master Degree Programme  
 Master of Science, Physics Erasmus Mundus  
 Joint Degree Programme in Astrophysics  
 (Astromundus)



University of Innsbruck  
 Tilmann Märk  
 Rektor

innsbruck, [redacted]



Università degli Studi di Padova  
 Giuseppe Zaccaria  
 Rettore



University of Belgrade  
 Vladimir Bumbaširević  
 Rektor



*Ulrike Beisiegel*

University of Göttingen  
 Ulrike Beisiegel  
 Präsidentin





# Yearly Retreats



Central event of AstroMundus!

- 2011, 2012, 2016: Asiago Observatory (Padova)
- 2013, 2014, 2018: Conference Centre Obergurgl (Innsbruck)
- 2015, 2017: L'Aquila, ASI (Rome)
- 2019: Petnica (Belgrade)

Meeting of

- two editions of students
- members of Board, Selection, Quality Evaluation Committee, Academic Advisors
- lecturers and tutors

Many different activities take place

- meetings of the committees
- feedback sessions with the students
- presentations of the Master's theses of the older edition
- informal discussions of students with potential Master's theses supervisors
- lots of opportunity for exchange of experience and informal discussions

# Yearly Retreats



# Yearly Retreat in 2015

## visit to Gran Sasso Lab



# Joint Supervisions of Master Theses

- the students can make use of the experience of two different scientists resulting in particularly good theses
- the two supervisors from two different universities start collaborating scientifically resulting in common publications and sometimes even in continuing collaborations
- the frequent visits/teleconferences/presentations involved in the joint supervision brings both partners closer together

... was particularly helpful to integrate Belgrade!

# Scientific Advisory Board



- **Prof. Andrew Bunker**  
(Department of Physics, University of Oxford, UK)
- **Prof. Jan Palous**  
(Astronomical Institute of the Academy of Sciences of the Czech Republic)
- **Prof. Bozena Czerny**  
(Center for Theoretical Physics, Warsaw, Poland)

Former members:

- **Prof. Dr. Joachim Wambsganß**  
(Astronomisches Rechen-Institut, Heidelberg)
- **Prof. Malcolm Longair**  
(Cavendish Laboratory, Department of Physics, University of Cambridge)

# Astromundus in Serbia



- Partnet Country– fully integrated in the programme!
- Officially led by the University of Belgrade and Faculty of Mathematics



# Mater Thesis in Belgrade Ed. 1

1. *Payaswini Saikia „The UV and optical spectral properties of a sample of broad line AGNs“*  
*JOINT THESIS: Belgrade+Goettingen*  
(advisors: Luka Popovic, Wolfram Kollatschny)
2. *Nemanja Rakic „Variability of AGN spectral properties“*  
*JOINT THESIS: Belgrade+Goettingen*  
(advisors: Luka Popovic, Wolfram Kollatschny)
3. *Luca Grassitelli „Physical Parameters of the Relativistic Shock Waves in a Sample of Gamma Ray Bursts“*  
(advisors: Luka Popovic, Sasa Simic)



# Best Thesis Award Edition 1

- *Payaswini Saikia*

*„The UV and optical spectral properties of a sample of broad line AGNs“*

*Advisors:*

*Luka Popovic &  
Wolfram Kollatschny*





# Mater Thesis in Inns. & Belgrade Ed.2

4. Levan Kakabadze „**Contribution of Structure Formation Cosmic Rays to Extragalactic Gamma-Ray Background** “

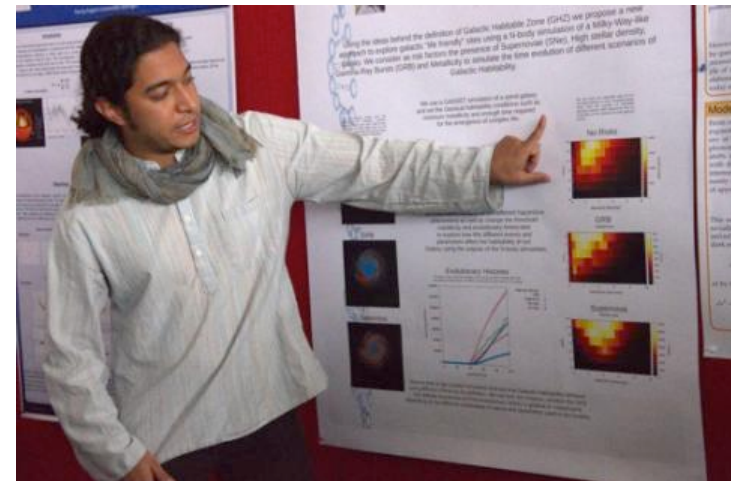
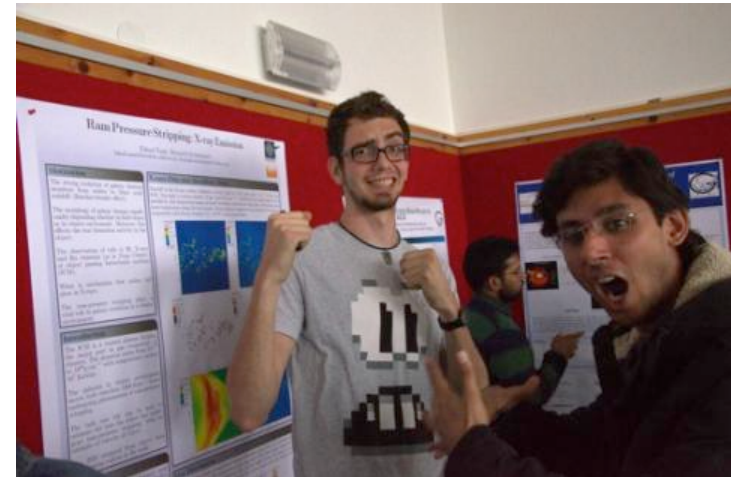
**JOINT THESIS: Innsbruck + Belgrade** (Advisors:

*Tijana Prodanovic, Olaf Reiner)*

5. Gerardo Martinez Aviles „**On the Evolution of Galactic Habitability Zone**“

**JOINT THESIS: Innsbruck + Belgrade** (Advisors:

*Branislav Vukotic & Sabine Schindler)*



# Best Thesis Award Edition 2

- *Gerardo Martinez Aviles*

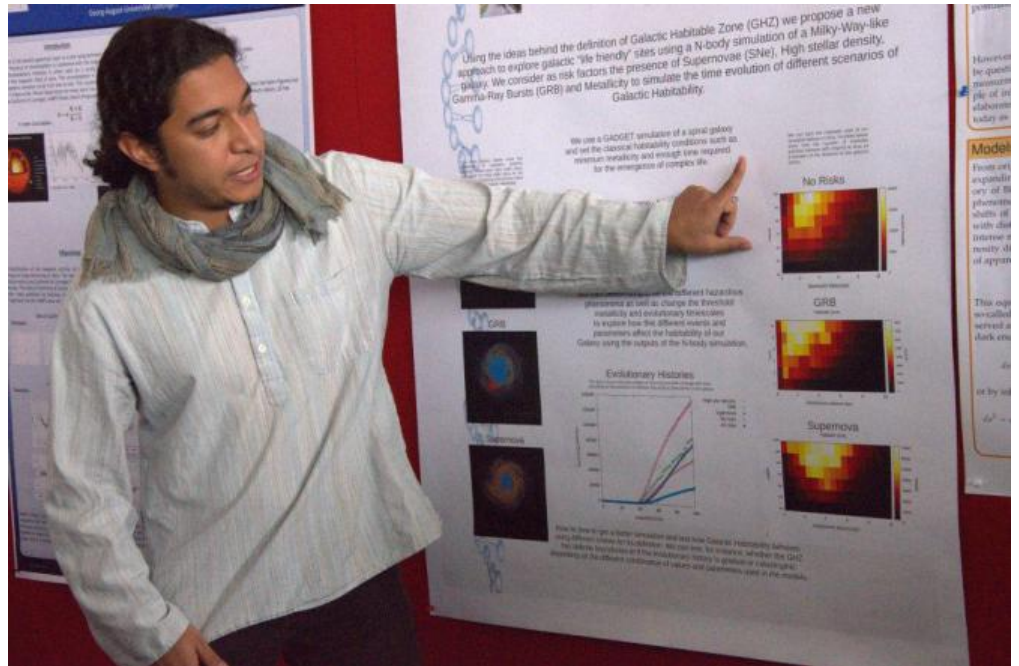
*Joint thesis*

*Innsbruck + Belgrade*

*Advisors:*

*Branislav Vukotic &*

*Sabine Schindler*



# Edition 3 & 4: Joint Master Thesis

6. KAMALI Fateme „**AGN Black Hole Masses at Different Cosmological Scales** “  
*JOINT THESIS: Goettingen + Belgrade*  
(advisors: Luka Popovic, Wolfram Kollatschny)
7. KOKOTANEKOVA Rosita Dimitrova „**X-RAY WEAK QUASARS** “  
*JOINT THESIS: Goettingen + Belgrade*  
(advisors: Luka Popovic, Wolfram Kollatschny)
8. SHORT Lawrence Anthony “**Comparison of Predicted and Observed Period Derivatives of RR Lyrae Stars**”  
*JOINT THESIS: Rome + Belgrade*  
(advisors: Giuseppe Bono, Dragana Ilic)

# Edition 5: Master Thesis

9. Miika Pursiainen ***“The shape of the broad iron  $K\alpha$  line and the effect of the accretion disc parameters in type 1 AGN”*** – BELGRADE (advisors: Luka Popovic, Predrag Jovanovic)
10. Ernesto Perez Hernandez  
***„Variability properties of the continuum and emission lines of type 1 AGNs: Periodicity and Time delays Evolution“***  
***JOINT THESIS: Goettingen + Belgrade***  
(advisors: Andjelka Kovacevic, Wolfram Kollatschny)
11. Jana Khusanova  
***„Adaptation of LSST software stack to ESO-NNT SOFI near-infrared camera “***  
***JOINT THESIS: Innsbruck + Belgrade***  
(advisors: Darko Jevremovic, <http://www.astro.univ-belgrade.rs> Giovanna Temporin)



# Edition 6: Master Thesis

12. Miriam Gudino *“The Hubble constant from time-delays of gravitationally lensed quasars”* (advisors: Predrag Jovanovic)



# Edition 7: Master Thesis

13. Agata M. Wisłocka

***“The Radiation Impact of Active Galactic Nuclei at on the Milky Way’s Planetary Atmospheres”***

(supervisor: Andjelka B. Kovačević, Andrea Balbi)

14. Adrián Castañón Esteban ***“Blast Waves with Cosmic Rays”***

(supervisor: Bojan Arbutina)

15. Abhishek Chougule

***“Influence of improved Stark broadening data on chromium spectral lines”***

**JOINT THESIS Innsbruck + Belgrade**

(supervisors: Norbert Przybilla, Milan S. Dimitrijevic)



We are proud of

Our students!



Edition 8, 3<sup>rd</sup> semester in Belgrade

# Truly international programme...

**45** nationalities/number of **students 118** (editions 1-8)

Armenian 1  
Austrian 2  
Azerbaijan 1  
Bangladeshi 2  
Bolivian 1  
Brazil 1  
British 4  
Bulgarian 2  
Chilean 2  
Chinese 4  
Colombian 2  
Croatian 1  
Egyptian 1  
Ethiopian 1  
Finnish 1

French 1  
Georgian 2  
Germany 1  
Greek 1  
Guatemalan 2  
Hungarian 1  
**Indian 15**  
Indonesian 1  
Iranian 2  
Irish 1  
Italian 4  
Macedonian 1  
Mexican 8  
Nepalese 2  
Pakistani 4

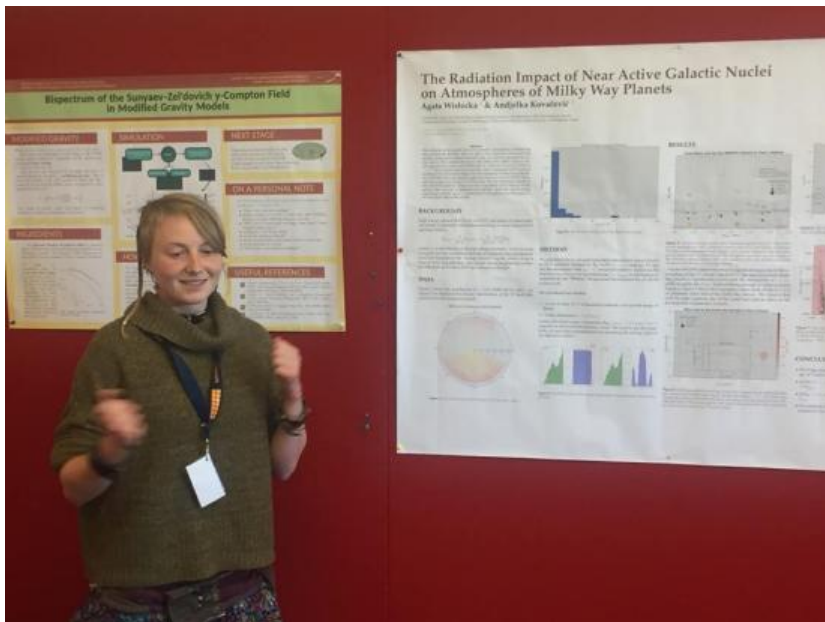
Peruvian 1  
Polish 2  
Russian 2  
**Serbian 7**  
Slovenian 2  
South African 1  
Spanish 5  
Taiwanese 2  
Turkish 4  
USA 8  
Ugandan 1  
Ukrainian 6  
Venezuelan 2  
Vietnamese 3

gender balanced (~50% female)



# We are proud of



- Magazine Forbes  
Interview with Agata M. Wisłocka



**Forbes**      Billionaires   Innovation   Leadership   Money   Consumer   Industry   Lifestyle


2,656 views | Sep 28, 2018, 07:39pm


## Active Supermassive Black Holes May Have Quashed Life's Emergence


 **Bruce Dorminey** Contributor   
[Science](#)  
*I cover over-the-horizon technology, aerospace and astronomy.*


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**TWEET THIS**

 with the right numbers, the AGNs could have had an effect on the development of planetary systems."

 It's only the AGNs closest to us that would have most of the effect, she says.

 Active galactic nuclei (AGNs) --- powered by supermassive black holes at the centers of most young galaxies --- may have put the quash on life's evolution, says one new study.







# Results of our Alumni

AstroMundus alumni who continued their career in Astrophysics are very active in publishing their new research results. Here are reported only some outstanding examples of works they authored or participated in as co-authors as PhD students mostly within large international teams.



As a PhD student at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute) and Leibniz University, Hannover, the AstroMundus alumnus Avneet Singh participated in the Gravitational Waves discovery paper, which reports the first detection of gravitational waves that marked the opening of a new observational window in Astrophysics.

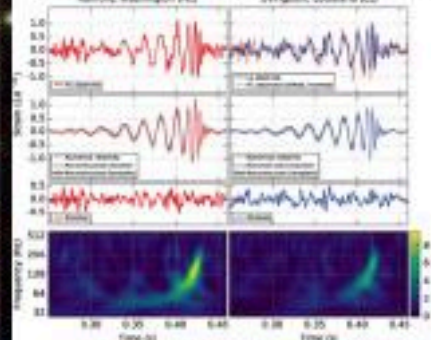
The detection of gravitational waves from another black hole merger with the combined use of 2 Advanced LIGO detectors and the Advanced VIRGO detector and, for the first time, the detection of gravitational waves from a binary neutron star merger were announced in two subsequent papers that saw the participation of two AstroMundus alumni as members of the research team: Avneet Singh and Odysse Malim, PhD student at the Gran Sasso Science Institute, L'Aquila. The latter detection was particularly important, because for the first time it was possible to combine the gravitational wave signal with the emission across the electromagnetic spectrum that accompanies a neutron star merger event.

The paper reporting the observation of a kilonova as the electro-magnetic counterpart of a gravitational wave source has seen another AstroMundus alumnus in the authoring team, Aleksandar Cikota, ESO fellow at the International Max Planck Research School in Garching.

## Observation of Gravitational Waves from a Binary Black Hole Merger

B. P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration) | Phys. Rev. Lett. 116, 2016 | Published February 11, 2016

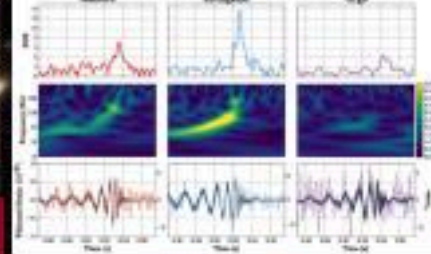
DOI: <https://doi.org/10.1103/PhysRevLett.116.061102>



## GW150914: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence

B. P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration) | Phys. Rev. Lett. 116, 2016 | Published February 11, 2016

DOI: <https://doi.org/10.1103/PhysRevLett.116.141101>



## GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral

B. P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration) | Phys. Rev. Lett. 118, 2017 | Published October 26, 2017

DOI: <https://doi.org/10.1103/PhysRevLett.118.161101>

Letter | Published 26 October 2017

### A kilonova as the electromagnetic counterpart to a gravitational-wave source

L. J. Shappee<sup>1</sup>, T. W. Chiu<sup>1</sup>, J.-I. O. Mouri<sup>1</sup>, ...

DOI: <https://doi.org/10.1038/nature21681>

RECEIVED 15 JULY 2017 | PUBLISHED 26 OCTOBER 2017 | Download Citation

Letter | Published 24 August 2016

### A terrestrial planet candidate in a temperate orbit around Proxima Centauri

Gaia-1 b (Gaia DR2) | Peter J. Fegredo<sup>1</sup>, L. J. Matthews<sup>1</sup>, ...

RECEIVED 10 JULY 2016 | PUBLISHED 24 AUGUST 2016 | Download Citation

doi:10.1038/nature16745 — Science Release

### Planet Found in Habitable Zone Around Nearest Star

Pale Red Dot campaign reveals Earth-mass world in orbit around Proxima Centauri

24 August 2016



As a PhD student at the Institute for Astrophysics at the University of Göttingen, the AstroMundus alumnus Christopher J. Fegredo took part in the discovery of an Earth-mass planet orbiting the nearest star to the Sun, Proxima Centauri. Its temperature is within the favourable range for liquid water to be present on the surface.

### THE ASTROPHYSICAL JOURNAL LETTERS

#### THE UNIFICATION OF POWERFUL QUASARS AND RADIO GALAXIES AND THEIR RELATION TO OTHER MASSIVE GALAXIES

Peter Podgajoski<sup>1</sup>, Peter Baethel<sup>1</sup>, Bernd Haas<sup>1</sup>, Christian Leipski<sup>1</sup>, and Bernd Wilkes<sup>1</sup>

Published 2017 June 4 • 0000000 • The American Astronomical Society. All rights reserved. <https://doi.org/10.1093/ajl/lax000>

### THE ASTROPHYSICAL JOURNAL LETTERS

#### Starburst-driven Superwinds in Quasar Host Galaxies

Peter Baethel<sup>1</sup>, Peter Podgajoski<sup>1</sup>, Bernd Wilkes<sup>1</sup>, and Matt Haas<sup>1</sup>

Published 2017 June 30 • 0000000 • The American Astronomical Society. All rights reserved. <https://doi.org/10.1093/ajl/lax000>



As a PhD student at the Kapteyn Astronomical Institute, University of Groningen, the AstroMundus alumnus Peter Podgajoski authored a study providing new hints to the unification model of Quasars and radio-galaxies and co-authored a paper on the discovery of prodigious starburst-driven superwinds in Quasar host galaxies.

# Erasmus+ Quality Review Report 2014

*“A panel of external experts assisted the Quality Review Committee in the evaluation of your report against the criteria indicated below and overall **your assessment was very good**. I am pleased to inform you that your above-mentioned EMMC has been **included** to the Erasmus Mundus Joint Master Degrees (EMJMD) **Catalogue**. “*

- Based on:
  - ✓ Relevance
  - ✓ Attractiveness
  - ✓ Level of integration
  - ✓ Sustainability





Thank you for your attention!



[www.astromundus.eu](http://www.astromundus.eu)

