

## Karolina Kubiak



### Title

Probing the effects of environment on star and brown dwarf formation

### Abstract

Brown dwarfs are a critical link between the realms of stars and planets. Their formation process is one of the crucial missing pieces in our understanding of how star and planet formation work. Understanding the origin of brown dwarfs is the main motivation for recent deep studies of star-forming regions and young clusters. The major question driving our studies is whether the birth environment affects their formation efficiency, as predicted in several formation scenarios. The expectation is that high gas or stellar densities or the presence of massive OB stars may be factors that boost the incidence of newly formed brown dwarfs with respect to stars. To address this question we investigate the stellar and sub-stellar objects in the drastically different environments of massive young clusters RCW 38 and NGC 2244 and that of nearby star-forming regions. Here we will present the current status of young brown dwarf studies, compare the low-mass Initial Mass Functions in a variety of Milky Way environments. For RCW38, we will address the high-mass IMF and the shallow slope that we see in the center (mass segregation or not?). We will summarised the implications of these results for our understanding of sub-stellar formation processes.

# CURRICULLUM VITAE ET STUDIORUM

## KAROLINA KUBIAK

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### CONTACT INFORMATION

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### RESEARCH FOCUS

Galactic Star Formation, Pre-main sequence stars, Young stellar objects,  
Young stellar clusters, Young brown dwarfs, Pre-main sequence binaries,  
Protoplanetary disks, Initial mass function

### EMPLOYMENT HISTORY

CENTRA - Faculdade de Ciencias 2019-Present  
Universidade de Lisboa

### EDUCATION

**Ph.D.** in Astronomy & Astrophysics Feb 2019  
Thesis advisor: Prof. Dr. Joao Alves  
Thesis title: "Orion Belt Population"

**Post-graduate studies** in range of pedagogical preparation 2011  
on Department of Journalism and in Superior Political Sciences in  
Academy of International Relations and American Studies

**M. Sc.** in Astronomy & Astrophysics 2011  
Wroclaw University, Physics and Astronomy Department,  
Specialization field: Astronomy  
Thesis advisor: Prof. Dr. Mikołaj Jerzykiewicz  
Thesis title: "Effective temperatures of B stars"

### LIST OF REFEREED PUBLICATIONS

- Orion revisited III. The Orion Belt population*  
**Kubiak, K.**, Alves, J., Bouy, H., Sarro, L. M., Ascenso, J., Burkert, A., Forbrich, J., Großschedl, J., Hacar, A., Hasenberger, B., Lombardi, M., Meingast, S., Köhler, R., Teixeira, P. S. 2017, *A&A*, 589, 124
- VISION - Vienna survey in Orion. III. Young stellar objects in Orion A* Großschedl, J. E., Alves, J., Teixeira, P. S., Bouy, H., Forbrich, J., Lada, Ch. J., Meingast, S., Hacar, A., Ascenso, J., Ackerl, Ch., Hasenberger, B., Köhler, R., **Kubiak, K.**, Larreina, I.; Linhardt, L., Lombardi, M., Möller, T. 2018, *A&A*, in press. <https://arxiv.org/abs/1810.00878>
- APOGEE strings: A fossil record of the gas kinematic structure*  
Hacar, A., Alves, J., Forbrich, J., Meingast, S., **Kubiak, K.**, Großschedl, J., 2016, *A&A*, 589, 80
- VISION - Vienna survey in Orion. I. VISTA Orion A Survey*  
Meingast, S., Alves, J., Mardones, D., Teixeira, P.S., Lombardi, M., Großschedl, J., Ascenso, J., Bouy, H., Forbrich, J., Goodman, A., Hacar, A., Hasenberger, B., Kainulainen, J., **Kubiak, K.**, Lada, C.,

## NOT REFEREED PUBLICATION

1. *Photometric Variability of T Tauri S as a Probe for Circumstellar Material*  
Köhler, R., **Kubiak, K.** 2020, Research Notes of the AAS, 4, 5, id.73

## WORK IN PREPARATION

- (a) *New low-mass members of Chamaeleon I and  $\epsilon$  Cha*  
**K. Kubiak**, K. Mužić, J. Sousa, V. Almendros-Abad, R. Köhler, and A. Scholz, submitted to A&A.
- (b) *The (Sub)stellar Content of the RCW38*  
**K. Kubiak**, K. Mužić, R. Schödel, J. Ascenso et al., in prep.
- (c) *The Orion Belt Population in Gaia DR2 - Distance, structure, and SED modeling*  
**K. Kubiak**, P. S. Teixeira, R. Köhler, J. Alves, O. Czoske, and T. Robitaille, in prep to resubmit to A&A
- (d) *Variability in the Orion Belt Population*  
**K. Kubiak**, P. S. Teixeira, R. Köhler, J. Alves, O. Czoske, and T. Robitaille, in prep to submit to A&A
- (e) *Radial velocity survey of the Orion Star Forming Region: remarkable dynamical cold structure*  
**Kubiak, K.**, Alves, J., Bouy, H., K. Strassmeier, M. Weber, in prep.
- (f) *B-stars in Orion: A large, homogeneous radial velocity survey of the complete Orion Star Forming Region*  
**Kubiak, K.**, Alves, J., Bouy, H., Köhler, R., Strassmeier, K., Teixeira, P.S., Weber, M., in prep

## INVITED TALKS AND SEMINARS

- (a) Institut für Astrophysik, Universität Wien, Austria 7 Apr 2017  
*Public lecture series - Nachts auf der Sternwarte ...*
- (b) Institut für Astro- und Teilchenphysik, Universität Innsbruck, Innsbruck, Austria 12 Dec 2016  
*JOINT Institute Seminar*
- (c) Leibniz-Institut für Astrophysik Potsdam (AIP), Potsdam, Germany, 9 Nov 2016  
*Celebrating 10 years of the STELLA robotic observatory*

## OBSERVING EXPERIENCE

High-resolution spectroscopy observations remotely with STELLA (SES) AIP Observatory on Tenerife Island (Canary Islands, Spain)	Jan-Feb 2016
High-resolution spectroscopy with Mercator Telescope (HERMES) Roque de los Muchachos Observatory on La Palma Island (Canary Islands, Spain)	Dec 2015
High-resolution spectroscopy observations remotely with STELLA (SES) AIP Observatory on Tenerife Island (Canary Islands, Spain)	Sep-Oct 2015
High-resolution spectroscopy with STELLA (SES) AIP Observatory on Tenerife Island (Canary Islands, Spain)	June 2015
High-resolution spectroscopy observations remotely with STELLA (SES) AIP Observatory on Tenerife Island (Canary Islands, Spain)	Feb 2015
High-resolution spectroscopy observations remotely with STELLA (SES) AIP Observatory on Tenerife Island (Canary Islands, Spain)	Oct 2014
Photometric observations with Johnson and Strömgen systems and with $H_{\alpha}$ filter at the 60-cm Cassegrain telescope Wrocław University Observatory, Białków, Poland	2003-2011

Solar observation with Large Coronagraph of Bialkow, Wroclaw University Observatory, Biaków, Poland	2003-2011
Spectral line observations at the RT-4 32 m radiotelescope, Toruń, Centre for Astronomy, Piwnice, Poland	2004

## OBSERVING PROPOSALS

<i>Probing the effects of environment on low-mass star and brown dwarf formation</i> Co-I, Paranal, HAWK-I/VLT, Awarded 15.5h (Period 104)	2019
<i>Radial velocity survey of the complete Orion Star Forming Region - supplementary observations</i> P.I. AIP STELLA (SES), Awarded 7 observing nights	2017
<i>A filler program to monitor orbital motion in young binaries</i> Co-I, Paranal, NACO, Awarded 14h (Period100A)	2017
<i>Multiplicity among young stellar objects in Orion A</i> Co-I, Paranal, NACO, Awarded 14h (Period100A)	2017
<i>A filler program to monitor orbital motion in young binaries</i> Co-I, Paranal, NACO, Awarded 21h (Period99A)	2016
<i>The VISTA Star Formation Atlas (VISIONS)</i> Co-I, Paranal, VISTA, part of the VISTA Public Surveys Awarded total time of 553h	2016(Period99A)
<i>Radial velocity survey of the complete Orion Star Forming Region</i> P.I. AIP STELLA (SES), RVS-Ori-15B Awarded 14 observing nights	2015
<i>Radial velocity survey of the complete Orion Star Forming Region</i> P.I., Mercator Telescope (HERMES), 42-MULTIPLE-2-15B Awarded 9 observing nights	2015
<i>Radial velocity survey of the complete Orion Star Forming Region</i> Co-I, RVS-Ori-15B Calar Alto Observatory (CAHA) 42-MULTIPLE-2-14B Awarded 9 observing nights	2014
<i>Radial velocity survey of the complete Orion Star Forming Region</i> Co-I, AIP STELLA (SES), 42-MULTIPLE-2-14B <b>Awarded 20 observing nights asked only for 9</b>	2014

## SKILLS

*Programming Languages:* C, C++, and Python  
*Operating Systems:* UNIX, LINUX, WINDOWS, MAC OS X;  
*Programming:* python, C++, Fortran, IDL;  
*Text processing:* LATEX2e, Word;  
*Web-publishing:* HTML  
*ICT / Internet communications:* Zoom, Slack, Google Drive (cloud storage managing);  
*Astronomical data processing:* IRAF, SExtractor, AstroPy, Daophot, TopCat, Vizier, MESA, Glue  
**Certificate of competency of motorboat helmsman:** patent nr 222751;  
*Experience in organizing and hosting scientific conferences, workshops and meetings.*  
*Driving licence with experience to drive Light commercial vehicles.*

## LANGUAGES

Fluent in both Polish and English. Knowledge of German. Elementary of Portuguese.

## ATTENDED CONFERENCES, WORKSHOPS AND SCHOOLS

"European Week of Astronomy and Space Science" <b>Presented talk, On the nature of the Orion Belt Population sources</b>	Jun 2019
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Manufacture des tabacs, Univ. of Lyon 3, Lyon, France  
<https://eas.unige.ch/EWASS2019/program.jsp>

"Orion Uncovered" Aug 2019  
**Presented talk**, *On the nature of the Orion Belt Population sources*  
 Leiden, The Netherlands  
<https://sites.google.com/view/OrionLeiden2019>

"Crete III: Through dark lanes to new stars" Sep 2019  
**Presented poster**, *On the nature of the Orion Belt Population sources*  
 Crete, Greece  
<https://crete3.org>

"The Wonders of Star Formation" Sep 2018  
**Presented talk**, *On the nature of the Orion Belt Population sources* Edinburgh, Scotland  
<https://events.ph.ed.ac.uk/star-formation/programme>

"The IMPACT of BINARIES on STELLAR EVOLUTION" Jul 2017  
**Presented poster** with title, *Dynamical Masses of young visual binaries as test for pre-main-sequence evolutionary models* as co-author. ESO, Garching, Germany

"European Week of Astronomy and Space Science" Jun 2017  
**Presented talk**, *A large, homogeneous radial velocity survey of the complete Orion Star Forming Region*  
**Presented talk**, *A spectroscopic survey of all massive stars in the Orion constellation*  
 Faculty of Law of the Charles University, Prague, Czech Republic

"Celebrating 10 years of the STELLA robotic observatory" Nov 2016  
**Presented talk**, *B-stars in Orion: clues on the formation of clusters and associations* Leibniz-Institut für Astrophysik Potsdam (AIP), Potsdam, Germany

"European Week of Astronomy and Space Science" Jul 2016  
**Presented talk**, *Orion Belt Population* Eugenides Foundation, Athens, Greece

Potsdam Astrophysical Summer School 2016 Jun 2016  
 "Quantitative Spectroscopy in Astrophysics"  
 Leibniz Institute for Astrophysics Potsdam (AIP), Potsdam, Germany

"European Week of Astronomy and Space Science" Jun 2015  
**Presented poster** with title, *More Orion Revisited: radial velocity survey of the complete Orion Star Forming Region*  
 La Laguna, Tenerife, Canary Islands, Spain

MOST Science team meeting Dec 2014  
**Presented talk**, *Epsilon Orionic*  
 Institut für Astrophysik, Universität Wien, Vienna, Austria

"Astronomy and Astrophysics Schools: Scientific Writing for Young Astronomers" Aug 2014  
 Tihany, Hungary

"IAU 307: New windows on massive stars" Jun 2014  
 Uni Dufour, Geneva, Switzerland

"MOST Science team meeting" Dec 2013  
**Presented talk**, *Epsilon Orionic*  
 Institut für Astrophysik, Universität Wien, Vienna, Austria

"IAU Symposium: Precision Asteroseismology" Aug 2013  
 Celebration of the Scientific Opus of Wojtek Dziembowski"  
 Wrocław, Poland

*Training course: Working with the student in order to support its growth, ability and creativity* Feb 2013  
 Bełchatów, Poland

*Operon* Dec 2012  
 Training program in preparation for the exam in physics, chemistry for the student and teacher

Piotrków Trybunalski, Poland

*Training course:*

Sep 2012

Application of the principle of equal opportunities for women and men  
in the projects of The Operational Programme Human Capital Bełchatów, Poland

Participated in the project, the Centre for Civic Education, "School with Class 2.0".

2012

## ACADEMIC TEACHING EXPERIENCE

Co-advising of PhD student:

2019-present

V. Almendros-Abad

*Young brown dwarfs as testbeds for star and planet formation*

Supervising of Master student:

2020-present

Afonso M. R. G. do Brito do Vale

*Blinking lights in Taurus: long-term variability of young stars and brown dwarfs*

Co-supervising of Master student:

2019-present

André Gonçalo Costa Bapista

*Hunting for Brown Dwarfs in Corona Australis*

Supervising of Bachelor student:

2019-2020

Ines Sousa

*Search for Young stars on the Chamaeleon Region*

Publication based on the project results has been submitted to A&A.

Co-supervising of Bachelor student:

2019-2020

Lara Piscarreta

*Revealing the secrets of the Unicorn: Multi-wavelength wide field study of the massive star forming region Monoceros R2*

## Personal interests

Science, Calligraphy, Trekking and Hiking, Horse back riding, Cooking, Sailing