

Gesa H.-M. Bertrang

Max Planck Institute for Astronomy
Heidelberg, Germany
☎ (+49) 06221-528-367
✉ bertrang@mpia.de
🌐 www.gesabertrang.com

Curriculum Vitae

(Last update: Jul 13, 2020)

Research Interest

- Planet and Star Formation
 - Magnetic field influence on protoplanetary disks and star-forming regions
 - Dust grain characterization
 - Planet-disk interactions
- Simulations/theory
 - 3D Radiative transfer simulations of dusty circumstellar environments
 - Continuum polarization and dust grain alignment processes
 - Gas polarization, esp. Goldreich-Kylafis effect in different environments
- Observations
 - High-angular resolution observations, imaging and spectroscopy
 - Continuum polarimetry from optical to mm-wavelengths
 - Spectro-polarimetry with focus on (sub)-mm wavelengths
- Code development
 - Python: – Data reduction pipelines (NTT/SOFI, VLT/ISAAC, IGO/IFOSC)
– Various scripts for data analysis and plotting
 - Fortran: Radiative transfer simulations (MC3D, Mol3D, LinePol)

Academic Achievements

- 19 refereed journal articles, 4 as first author, 3 as second author and in supervisory role; 400+ citations (h-index = 11; i10-index = 12)
- 211'000 EUR+ grant income as PI
- PI of 146+ hours observing time on major ground-based facilities, including ALMA, VLT, APEX, NTT

Education

- 2011–2015 **PhD (Dr. rer. nat.) in astrophysics**, *Kiel University*.
Advisor: Sebastian Wolf
- 2005–2010 **Diplom in physics (M.Sc. + B.Sc. equivalent)**, *Kiel University*.
Advisor: Sebastian Wolf

Work Experience

- 2018–2023 **Senior postdoctoral research associate**.
Max Planck Institute for Astronomy (MPIA)
- 2017–2018 **Fellowship at FONDECYT (Chilean Science Foundation)**.
Universidad de Chile
- 2015–2017 **Fellowship at MAD nucleus (Chilean Science Foundation)**.
Universidad de Chile & Universidad Diego Portales
- 2008–2010 **Research student**, *Polarization as magnetic field tracer in star formation*.
Kiel University

Awards and Distinctions

- 2017 – 2018 **Postdoctoral Fellowship Grant**, by the Chilean science foundation CONICYT.
PI: G Bertrang (EUR 110'000)
- 2015 – 2017 **Postdoctoral Fellowship Grant**, within MAD (Millenium ALMA Disk) nucleus, by the Chilean science foundation CONICYT.
PI: G Bertrang (EUR 100'000)
- 2018 IAU travel grant, IAU XXX General Assembly, Vienna, Austria.
PI: G Bertrang (EUR 540)
- 2017 IAU travel grant, IAU Division F meeting Astrobiology 2017, Chile, Coyhaique.
PI: G Bertrang (EUR 300)
- 2017 ERASMUS+ travel grant, "The Early History of Planetary systems and habitable planets", Estonia, Tartu.
PI: G Bertrang (EUR 400)
- 2005 **DPG (German Physical Society) Special Award**, for outstanding performance in physics.
- 2005 **DPG (German Physical Society) Award**, for excellent performance in physics.

Teaching and Mentoring

– TEACHING –

- Sep 2020 **Lecturer**
Invited lecture on basics of polarization in planet formation
(graduate level); International Max Planck Research School (IMPRS)
- Jan 2019 **Lecturer**
Lecture on basic physics of planet formation, focused on optical observations II
(graduate level); Max Planck Institute for Astronomy
- Nov 2018 **Lecturer**
Lecture on basic physics of planet formation, focused on optical observations I
(graduate level); Max Planck Institute for Astronomy
- Apr 2015 – **Co-Examiner (written)**; Physik IV: Kern-, Teilchen-, Astro-
Sep 2015 physik und Kosmologie (*nuclear, particle, astrophysics and cosmology*)
undergraduate level; Kiel University
- Apr 2014 – **Co-Examiner (written)**; Physik IV: Kern-, Teilchen-, Astro-
Sep 2014 physik und Kosmologie (*nuclear, particle, astrophysics and cosmology*)
undergraduate level; Kiel University
- Apr 2014 – **Instructor**; Physik IV: Kern-, Teilchen-, Astro-
Sep 2014 physik und Kosmologie (*nuclear, particle, astrophysics and cosmology*)
undergraduate level; Kiel University
- Oct 2013 – **Co-Examiner (oral)**; Bachelorprüfungen in Astrophysik für Physik im Haupt-
Mar 2014 fach & Lehramt (*Bsc. exams in astrophysics for major in Physics & teachers*)
undergraduate level; Kiel University

- Apr 2012 – **Co-Examiner (oral)**; Bachelorprüfungen in Astrophysik für Physik im Haupt-
 Sep 2013 fach & Lehramt (*Bsc. exams in astrophysics for major in Physics & teachers*)
 undergraduate level; Kiel University
- Oct 2011 – **Instructor; responsible for exercise design**; Elementare Mathematische
 Mar 2012 Methoden der Physik I (*elementary mathematical methods in physics I*)
 undergraduate level; Kiel University
- Apr 2011 – **Instructor**; Elementare Mathematische Methoden der Physik II
 Sep 2011 (*elementary mathematical methods in physics II*)
 undergraduate level; Kiel University

– MENTORING –

- Aug 2018 – **PhD student**: Major – Astrophysics
 ongoing *Students*: Lizxandra Flores (MPIA)
Co-Supervisor to Mario Flock (MPIA)
- Aug 2018 – **PhD student**: Major – Astrophysics
 ongoing *Students*: Marcelo Barraza (MPIA)
Co-Supervisor to Mario Flock (MPIA)
- Mar 2017 – **Bachelor student**: Major – Astrophysics
 Apr 2018 *Student*: Sebastián Jorquera (University of Chile)
Publication: Jorquera & Bertrang (2018), A&A, 618, 163

Outreach

- 2020 Jan Talk at "*Faszination Astronomie*" at HdA, Heidelberg
- 2019 Nov Talk at the *Koblenz Technology Night*, Koblenz
- 2019 Jul Talk to the 50th anniversary of MPIA at HdA, Heidelberg
- 2019 Jan Talk at *Astronomy on Tap*, "*Making the invisible visible*", Heidelberg
- 2015 Jun *Newspaper article* to the 350th anniversary of Kiel University
- 2013 Jun Girls Day, *Solar observations*, Kiel University

Invited Talks (34)

- 2020 Sep Summer school: IMPRS school on Protoplanetary Disks, Heidelberg, Germany.
- 2020 Aug Astronomical Colloquium: Herzberg Astrophysics, DRAO, Canada, virtually.
- 2020 Jun Conference: Cores2Disks II, Orsay/Paris, France.
- 2020 May Workshop: Thinkshop on Protoplanetary Disk Chemodynamics, Potsdam, Germany.
- 2020 Apr Workshop: The building blocks of planets, Ringberg Castle, Germany.
- 2020 Jan **Astronomical Colloquium**, Tübingen University, Germany.
- 2020 Jan Workshop: VLTI/Gravity, Heidelberg, Germany.
- 2019 Dec **Lorentz Workshop: Directly Imaging Exoplanets in Polarized Light with ELTs**, Leiden, Netherlands.
- 2019 Nov **Conference: Science of Early Life**, Kloster Seeon, Chiemsee, Germany.

- 2019 Oct **ESO**, European Southern Observatory; Garching.
- 2019 Sep Workshop: From protoplanetary discs to planetary systems, Ringberg Castle, Germany.
- 2019 Aug **NOAO**, National Optical Astronomy Observatory; Tuscon, USA.
- 2019 Aug **Steward Observatory**, Tuscon, USA.
- 2019 Aug CSUN, California State University; Northridgem USA, cancelled.
- 2019 Aug **MIT**, Kavli Institute, Cambridge, USA.
- 2019 Aug **Harvard**, Center for Astrophysics (CfA), Cambridge, USA.
- 2019 Aug Boston University, Boston, USA.
- 2019 Jul Workshop: Turbulence and Structure Formation in PPDs, Ringberg Castle, Germany.
- 2019 Mar **Oxford**, Atmospheric Oceanic and Planetary Physics (AOPP), UK.
- 2018 Sep **MPIA**, Königstuhl Colloquium, Heidelberg, Germany.
- 2018 Jun Workshop: Hide and Seek: Where are the young planets?, Madrid, Spain.
- 2018 Mar **Joint ALMA Observatory**, Santiago, Chile.
- 2018 Nov Valparaiso, Physics and Astronomy Institute (IFA), University of Valparaiso, Chile.
- 2017 Nov Concepcion, Department of Astronomy, University of Concepcion, Chile.
- 2017 Mar Vienna, Department of Astrophysics, University of Vienna, Austria.
- 2017 Aug **MPIA**, Max Planck Institute for Astronomy; Heidelberg, Germany.
- 2017 Jul Lisbon, Astronomical Observatory of Lisbon, Portugal.
- 2017 Jan **ETHZ**, Zurich, Switzerland.
- 2016 Oct **Grenoble**, l'Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), France.
- 2016 Sep Kiel, Institute for Theoretical Physics and Astrophysics (ITAP), Germany.
- 2016 Aug **MPIA**, Max Planck Institute for Astronomy; Heidelberg, Germany.
- 2016 Jan Santiago, Pontificia Universidad Católica de Chile (PUC), Chile.
- 2015 Nov Santiago, European Southern Observatories (ESO), Chile.
- 2012 Nov Santiago, European Southern Observatories (ESO), Chile.

Organisation of scientific meetings

- 2020 July 27-31 **virtual LOC ("Moderator")** of "Exoplanets 3", *Conference*.
Virtual Space
- 2020 Apr 14-18 **SOC** of "Simulations and observations of the building blocks of planets", *Workshop*.
Ringberg Castle, Germany
- 2019 Sep 19 **SOC** of "Cosmic dust and spectral line polarization as analytical tools: Bridging spatial and spectral scales & SOFIA's promise ", *Splinter session during the Annual Meeting of the German Astronomical Society in 2019*.
Stuttgart, Germany

- 2019 Sep 17-18 **SO**C of "From protoplanetary disks to exoplanets - the story of their formation", *Splinter session during the Annual Meeting of the German Astronomical Society in 2019*.
Stuttgart, Germany
- 2015 - 2017 Disk and Planet **Seminar Organizer and Host**.
Universidad de Chile and Universidad Diego Portales
- 2014 Sep **LOC** of "Planet formation and evolution 2014 workshop", Kiel, Germany.
- 2010 Jul **LOC** of "Second Chinese-German workshop on Star and Planet formation", Kiel, Germany.

Services

- since 2020 **Conflict coach at MPIA**.
- since 2019 **Time Allocation Committee, SOFIA**.
- since 2018 **Hiring panel for Postdoctoral Fellows at MPIA's PSF department**.
- since 2018 **Internal Scientific Advisory Board at MPIA**.
Wissenschaftlicher Beraterkreis (WBK)
- since 2018 **Postdoc Representative at MPIA**.
- 2012 - 2014 **Section committee of the physics department of Kiel University**.
Representative of research assistants and associates
Letter of Recommendation Writer for Students
Referee for Astrophysical Journal, Astronomy & Astrophysics, and Publications of the Astronomical Society of Japan

Memberships

- AG **Astronomische Gesellschaft**, *German Astronomical Society*.
- DPG **Deutsche Physikalische Gesellschaft**, *German Physical Society*.
- EAS **European Astronomical Society**.
- EAI **European Astrobiology Institute**.

Observation Record as PI

Total amount: > 146 hrs

- 2019 **ALMA**, *Measurements of the magnetic field structure in the nearest protoplanetary disk*, 2019.1.00249.S, 6 hrs.
- 2018 **ALMA**, *Measurements of the magnetic field structure in the nearest protoplanetary disk*, 2018.1.00460.S, 6.1 hrs.
ALMA, *The nature of continuum polarization in protoplanetary disks*, 2018.1.00373.S, 3.1 hrs.
- 2017 **ALMA**, *The nature of continuum polarisation in protoplanetary disks*, 2017.1.00892.S, 18.3 hrs.
VLT/SPHERE, *Bringing disks to life: tracing the short-time dynamics in the protoplanetary disk around HD 169142*, 0101.C-0595, 1.2 hrs.

- 2016 **APEX/ARTEMIS**, *The nature and origin of the Solar system scale disk in the Helix Nebula: Complementing ALMA.*, C 097.F 9704C 2016, 18.6 hrs.
(Visiting observer for 7 days)
- 2015 **NTT/SOFI**, *Revealing the magnetic field strength and structure of Bok globules on a wide range of scales*, 096.C 0115(A), 5 nights.
(Visiting observer)
- 2013 **NTT/SOFI**, *Connecting large and small-scale magnetic field structures in Bok globules*, 090.C 0785(A), 3 nights.
(Visiting observer)
- 2012 **VLT/ISAAC**, *Connecting large and small-scale magnetic field structures in Bok globules*, 089.C 0846(A), 15.6 hrs.

Publication Record (*ads*)

"+": three most important papers

A. First, second author and advisee refereed publications

- + **7.** *"Self-scattering on non-spherical dust grains"*
Kirchschlager, F. and **Bertrang, G. H.-M.**, 2020, accepted by A&A, arXiv:2004.13742
My contribution to this project is the idea, planning, and analysis of this project along with significant text contributions to sections 1, 3, 4, and 5.
- 6.** *"Intrinsic polarisation of elongated porous dust grains"*
Kirchschlager, F., **Bertrang, G. H.-M.**, Flock, M., 2019, MNRAS, 488, 1211
My contribution to this project is the idea, planning, and analysis of this project along with significant text contributions to sections 1, 3.2, 4, and 5.
- + **5.** *"HD 169142 in the eyes of ZIMPOL/SPHERE"*
Bertrang, G. H.-M., Avenhaus, H., Casassus, S., Montesinos, M., Kirchschlager, F., Perez, S., Cieza, L., Wolf, S., 2018, MNRAS, 474, 5105
- 4.** *"Magnetic fields in Bok globules: multi-wavelength polarimetry as tracer across large spatial scales"*
Jorquera, S. and **Bertrang, G. H.-M.**, 2018, A&A, 618, A163
- 3.** *"3D radiative transfer of intrinsically polarized dust emission based on aligned aspherical grains"*
Bertrang, G. H.-M., Wolf, S., 2017, MNRAS, 469, 2869
- + **2.** *"Magnetic fields in protoplanetary discs: from MHD simulations to ALMA observations"*
Bertrang, G. H.-M., Flock, M, Wolf, S., 2017, MNRAS Letters, 464, L61
- 1.** *"Large-scale magnetic fields in Bok globules"*
Bertrang, G. H.-M., Wolf, S., Das, H. S., 2014, A&A, 565, A94

B. Other refereed publications

- 12.** *"Gap, shadows, spirals, streamers: SPHERE observations of binary-disk interactions in GG Tau A"*
Keppler, M., Penzlin, A., Benisty, M., van Boekel, R., Henning, T., van Holstein, R. G., Kley, W., Garufi, A., Ginski, C., Brandner, W., **Bertrang, G. H. -M.**, Boccaletti, A., et al., 2020, accepted by A&A, arXiv:2005.09037

11. *"Disks Around T Tauri Stars with SPHERE (DARTTS-S) II: Twenty-one new polarimetric images of young stellar disks "*
Garufi, A., Avenhaus, H., Perez, S., Quanz, S. P., van Holstein, R. G., **Bertrang, G. H. M.**; Casassus, S., Cieza, L., Principe, D. A., van der Plas, G., Zurlo, A., 2020, A&A 633, 82
10. *"Characterization of Ring Substructures in the Protoplanetary Disk of HD 169142 from Multi-Wavelength ALMA Observations"*
Macias, E., Espaillat, C., Osorio, M., Anglada, G., Torrelles, J. M., Carrasco-Gonzalez, C., Flock, M., Linz, H., **Bertrang, G. H. M.**; Henning, Th., et al., 2019, ApJ, 881, 159
9. *"A highly structured disk around the planet host PDS 70 revealed by high-angular resolution observations with ALMA"*
Keppler, M., Teague, R., Bae, J., Benisty, M., Henning, T., van Boekel, R., Chapillon, E., Pinilla, P., Williams, J. P., **Bertrang, G. H.-M.**, Facchini, S., et al., 2019, A&A, 625, 118
8. *"Resolved Imaging of the AR Puppis Circumbinary Disk"*
Ertel, S., Kamath, D., Hillen, M., van Winckel, H., Okumura, J., Manick, R., Boffin, H. M. J., Milli, J., **Bertrang, G. H.-M.**, Guzman-Ramirez, L., et al., 2019, ApJ, 157, 110
7. *"The Ophiuchus DIsc Survey Employing ALMA (ODISEA) - I: project description and continuum images at 28 au resolution"*
Cieza, L. A., Ruiz-Rodriguez, D., Hales, A., Casassus, S., Perez, S., Gonzalez-Ruilova, C., Canovas, H., Williams, J. P., Zurlo, A., Ansdell, M., Avenhaus, H., Bayo, A., **Bertrang, G. H.-M.**, Christiaens, V., et al., 2019, MNRAS, 482, 698
6. *"Disks around T Tauri Stars with SPHERE (DARTTS-S). I. SPHERE/IRDIS Polarimetric Imaging of Eight Prominent T Tauri Disks"*
Avenhaus, H., Quanz, S. P., Garufi, A., Perez, S., Casassus, S., Pinte, C., **Bertrang, G. H.-M.**, Caceres, C. Benisty, M. Dominik, C., 2018, ApJ, 863, 44
5. *"ALMA Observations of Elias 2-24: A Protoplanetary Disk with Multiple Gaps in the Ophiuchus Molecular Cloud"*
Cieza, L. A., Casassus, S., Perez, S., Hales, A. Carcamo, M., Ansdell, M., Avenhaus, H., Bayo, A., **Bertrang, G. H.-M.**, Canovas, H., et al., 2017, ApJ Letters, 851, L23
4. *"Radiation Hydrodynamical Turbulence in Protoplanetary Disks: Numerical Models and Observational Constraints"*
Flock, M., Nelson, R. P., Turner, N. J., **Bertrang, Gesa H.-M.**, Carrasco-Gonzalez, C., Henning, Th., Lyra, W., Teague, R., 2017, ApJ, 850, 131
3. *"Orbits in the T Tauri triple system observed with SPHERE"*
Köhler, R., Kasper, M., Herbst, T. M., Ratzka, T., **Bertrang, G. H.-M.**, 2016, A&A, 587, A35
2. *"An extreme-AO search for giant planets around a white dwarf. VLT/SPHERE performance on a faint target GD 50"*
Xu, S., Ertel, S., Wahhaj, Z., Milli, J., Scicluna, P., **Bertrang, G. H.-M.**, 2015, A&A Letters, 579, L5
1. *"Polarimetric studies of comet C/2009 P1 (Garrad)"*
Das, H. S., Medhi, B. J., Wolf, S., **Bertrang, G.**, Deb Roy, P., Chakraborty, A., 2013, MNRAS, 436, 3500

C. Other publications

9. *"On moving shadows and pressure bumps in HD 169142"*

Bertrang, G. H.-M., Flock, M., Keppler, M., Trifonov, T. Penzlin, A. , Avenhaus, H., Henning, T., Montesinos, M., 2020, submitted to A&A

8. "Self-scattering of non-spherical dust grains: The limitations of perfect compact spheres"

Kirchschlager, F. and **Bertrang, G. H.-M.**, 2020, submitted to A&A

7. "Planet-disk interactions in HD 169142? Tracing ellipticity, structures, and offsets"

Bertrang, G. H.-M. and Avenhaus, H., 2020, Origins: From the Protosun to the First Steps of Life. Proceedings of the International Astronomical Union, Volume 345, 241

6. "Magnetic fields in disks: A solution to an polarized ambiguity"

Bertrang, G. H.-M., Cortes, P., Flock, M., 2020, Astronomy in Focus XXX, presented at IAU XXX General Assembly, Vienna, Austria. Proceedings of the IAU, 130

5. "How to identify magnetic field activity in young circumstellar disks"

Flock, M and **Bertrang, G. H.-M.**, 2020, Astronomy in Focus XXX, presented at IAU XXX General Assembly, Vienna, Austria. Proceedings of the IAU, 126

4. "A young cousin of our solar system: New results from HD169142"

Bertrang, G. H.-M., 2019, American Astronomical Society, Extreme Solar Systems 4, id. 323.02. Bulletin of the American Astronomical Society, Vol. 51, No. 6

3. "Polarization in Disks"

Stephens, I., Li, Z.-Y., Yang, H., Kataoka, A., Looney, L., Hull, C., Fernandez-Lopez, M., Sadavoy, S., Kwon, W., Ohashi, S., Tazaki, R., Li, D., Hoang, T., **Bertrang, G. H.-M.**, Carrasco-Gonzalez, C., Dent, W., Takahashi, S., Bacciotti, F., Alves, F. O., Girart, J. M., Zhang, Q., Rao, R., Pohl, A., Padovani, M., Galli, D., Lee, C.-F., Segura-Cox, D., 2019, Astro2020: Decadal Survey on Astronomy and Astrophysics, science white papers, no. 246; Bulletin of the American Astronomical Society, Vol. 51, Issue 3, id. 246

2. "VizieR Online Data Catalog: Disks around T Tauri stars with SPHERE. II. (Garufi+, 2020)"

Garufi, A., Avenhaus, H., Perez, S., Quanz, S. P., van Holstein, R. G., **Bertrang, G. H.-M.**, Casassus, S., Cieza, L., Principe, D. A., van der Plas, G., Zurlo, A., 2019, VizieR On-line Data Catalog: J/A+A/633/A82. Originally published in: 2020A&A...633A..82G

1. " VizieR Online Data Catalog: Stokes param. of Bok globules background stars (Jorquera+, 2018)"

Jorquera, S. and **Bertrang, G. H.-M.**, 2018, VizieR On-line Data Catalog: J/A+A/618/A163. Originally published in: 2018A&A...618A.163J