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Nils Hoyer

3rd-year astronomy PhD student

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Research interests

- Nuclear star cluster formation, evolution, and demographics
- Relation between nuclear star clusters and supermassive black holes, globular clusters, and ultra-compact dwarf galaxies
- Scaling relations between compact systems and host galaxies
- Semi-analytical galaxy formation models

Work experience

- *Research assistant* (Sep 2020 - Aug 2021)
  Max-Planck-Institut für Astronomie, Heidelberg, Germany
  Advisor: Dr. Nadine Neumayer
- *Technical assistant* (Sep 2019 - Aug 2020)
  Max-Planck-Institut für Astronomie, Heidelberg, Germany
  Advisor: Dr. Nadine Neumayer

Education

- *PhD in Astrophysics* (Oct 2021 - today)
  Max-Planck-Institut für Astronomie, Heidelberg, Germany
  Donostia International Physics Center, Donostia–San Sebastián, Spain
  (*Including a two-month research stay at the Pontifical Catholic University of Chile*)
  Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
  Advisors: Dr. Nadine Neumayer, Prof. Dr. Silvia Bonoli
- *Master of Science in Physics* (Mar 2018 - Oct 2020)
  Max-Planck-Institut für Astronomie, Heidelberg, Germany
  Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
  Advisors: Dr. Nadine Neumayer, Dr. Iskren Y. Georgiev
  Examiners: Dr. Nadine Neumayer, Prof. Dr. Hans-Walter Rix
- *Bachelor of Science in Physics* (Oct 2014 - Feb 2018)
  Landessternwarte Heidelberg, Heidelberg, Germany
  Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
  Advisor: Prof. Dr. Jochen Heidt
  Examiners: Prof. Dr. Jochen Heidt, Prof. Dr. Andreas Quirrenbach

- *Highschool diploma* (Aug 2006 - Jul 2014)
  Johannes-Althusius Gymnasium, Bad Berleburg, Germany
  Gymnasium Bayreuther Strasse, Wuppertal, Germany

Additional scientific projects

- *Development of a generic double-charm trigger line for Run III of the LHCb experiment* (Aug 2018 - Aug 2019)
  Physikalisches Institut Heidelberg, Heidelberg, Germany
  CERN, Esplanade des Particules 1, Geneva, Switzerland
  Advisors: Prof. Dr. Sebastian Neubert, Dr. Nicole Skidmore
- *Generation of a quasar catalog optimized for adaptive optics-assisted observations at the Large Binocular Telescope* (Feb 2017 - May 2017)
  Landessternwarte Heidelberg, Heidelberg, Germany
  Advisor: Prof. Dr. Jochen Heidt

First-author publications

4. N. Hoyer, R. Arcodia, S. Bonoli, A. Merloni, N. Neumayer, Y. Zhang, and J. Comparat. Massive black holes in nuclear star clusters: An investigation with *SRG/eROSITA* X-ray data. *Astronomy & Astrophysics*, page 12, January 2024

3. N. Hoyer, F. Pinna, A. W. H. Kamlah, F. Nogueras-Lara, A. Feldmeier-Krause, N. Neumayer, M. C. Sormani, M. Boquien, E. Emsellem, A. C. Seth, R. S. Klessen, T. G. Williams, E. Schinnerer, A. T. Barnes, A. K. Leroy, S. Bonoli, J. M. D. Kruijssen, J. Neumann, P. Sánchez-Blázquez, D. A. Dale, E. J. Watkins, D. A. Thilker, E. Rosolowsky, F. Bigiel, K. Grasha, O. V. Egorov, D. Liu, K. M. Sandstrom, K. L. Larson, G. A. Blanc, and H. Hassani. PHANGS–JWST First Results: A combined *HST* and *JWST* analysis of the nuclear star cluster in NGC 628. *The Astrophysical Journal Letters*, 944(2):L25, February 2023

2. N. Hoyer, N. Neumayer, A. C. Seth, I. Y. Georgiev, and J. E. Greene. Photometric and Structural Parameters of Newly Discovered Nuclear Star Clusters in Local Volume Galaxies. *Monthly Notices of the Royal Astronomical Society*, 520(3):4664–4682, January 2023

1. N. Hoyer, N. Neumayer, I. Y. Georgiev, A. C. Seth, and J. E. Greene. The nucleation fraction of local volume galaxies. *Monthly Notices of the Royal Astronomical Society*, 507(3):3246–3266, November 2021

Co-author publications

5. M. Polkas, S. Bonoli, E. Bortolas, D. Izquierdo-Villalba, A. Sesana, L. Broggi, N. Hoyer, and D. Spinoso. Demogrpahics of Tidal Disruption Events with L-Galaxies. I. Volumetric TDE rates and the abundance of Nuclear Star Clusters. *Astronomy & Astrophysics*, page 25, December 2023

4. N. Mayker Chen, M. A. Tucker, N. Hoyer, S. W. Jha, L. Kwok, A. K. Leroy, E. Rosolowsky, C. Ashall, G. Anand, F. Bigiel, M. Boquien, C. Burns, D. Dale, J. M. DerKacy, O. V. Egorov, L. Galbany, K. Grasha, H. Hassani, P. Hoeflich, E. Hsiao, R. S. Klessen, L. A. Lopez, J. Lu, N. Morrell, M. Orellana, F. Pinna, S. K. Sarbadhicary, E. Schinnerer, M. Shahbandeh, M. Stritzinger, D. Thilker, and T. G. Williams. Serendipitous Nebular-phase JWST Imaging of SN Ia 2021aefx: Testing the Confinement of ^{56}Co Decay Energy. *The Astrophysical Journal Letters*, 944(2):L28, February 2023

3. J. C. Lee, K. M. Sandstrom, A. K. Leroy, D. A. Thilker, E. Schinnerer, E. Rosolowsky, K. L. Larson, O. V. Egorov, T. G. Williams, J. Schmidt, E. Emsellem, G. S. Anand, A. T. Barnes, F. Belfiore, I. Bešlić, F. Bigiel, G. A. Blanc, A. D. Bolatto, M. Boquien, J. den Brok, Y. Cao, R. Chandar, J. Chastenet, M. Chevance, I-D. Chiang, E. Congui, D. A. Dale, S. Deger, C. Eibensteiner, C. M. Faesi,

S. C. O. Glover, K. Grasha, B. Groves, H. Hassani, K. F. Henny, J. D. Henshaw, N. Hoyer, A. Hughes, S. Jeffreson, M. J. Jiménez-Donaire, J. Kim, H. Kim, R. S. Klessen, E. W. Koch, K. Kreckel, J. M. D. Kruijssen, J. Li, D. Liu, L. A. Lopez, D. Maschmann, N. Mayker Chen, S. E. Meidt, E. J. Murphy, J. Neumann, N. Neumayer, H.-A. Pan, I. Pessa, J. Pety, M. Querejeta, F. Pinna, M. Jimena Rodríguez, T. Saito, P. Sánchez-Blázquez, F. Santoro, A. Sardone, R. J. Smith, M. C. Sormani, F. Scheuermann, S. K. Stuber, J. Sutter, J. Sun, Y.-H. Teng, R. G. Tress, A. Usero, E. J. Watkins, B. C. Whitmore, and A. Razza. The PHANGS-JWST Treasury Survey: Star Formation, Feedback, and Dust Physics at High Angular resolution in Nearby GalaxieS. *The Astrophysical Journal Letters*, 944(2):L17, February 2023

2. H. Haidar, M. Habouzit, M. Volonteri, M. Mezcua, J. E. Greene, N. Neumayer, D. Anglés-Alcázar, I. Martin-Navarro, N. Hoyer, Y. Dubois, and R. Davé. The black hole population in low-mass galaxies in large-scale cosmological simulations. *Monthly Notices of the Royal Astronomical Society*, 514(4):4912–4931, June 2022

1. J. Heidt, A. Quirrenbach, N. Hoyer, D. Thompson, A. Pramskiy, G. Agapito, S. Esposito, R. Gredel, D. Miller, E. Pinna, A. Puglisi, F. Rossi, W. Seifert, and G. Taylor. 3C 294 revisited: Deep Large Binocular Telescope AO NIR images and optical spectroscopy. *Astronomy & Astrophysics*, 628:A28, August 2019

Publications covered in press releases

- ▹ *The James Webb Space Telescope Reveals the 'Bones' of Nearby Galaxies: New insight into where stars are being born in galaxies* (Feb 16, 2023)
  Published by the Max-Planck-Institut für Astronomie (MPIA)
  Written by Markus Nielbock

- ▹ *It's Full of Stars: The Mysterious Heart of the Phantom Galaxy* (Jan 19, 2023)
  Published by https://www.astrobites.org
  Written by H. Perry Hatchfield

Talks

21. UNAB Journal Club (Dec 18, 2023)
    The mysterious nuclear star cluster of M 74
    Facultad de Ciencias Exactas, Universidad Andrés Bello, Santiago de Chile, Chile

20. ESO Thirty Minutes Talks (TMT) (*invited*, Nov 28, 2023)
    Hunting massive black holes in nuclear star clusters with X-ray measurements from eROSITA
    European Southern Observatory, Santiago de Chile, Chile

19. DIPC-ICE Meeting (Nov 20, 2023)
    Nuclear star clusters and supermassive black holes
    Institut de Ciénces del Cosmos, University of Barcelona, Barcelona, Spain (remote)

18. Black Hole Seminar Series (*invited*, Nov 17, 2023)
    Supermassive black holes in nuclear star clusters: an observer's perspective
    Departamento de Astronomía, Universidad de Concepción, Concepción, Chile

17. Theory and Star Formation Meeting (Nov 17, 2023)
    Implementation of star clusters into the semi-analytical galaxy formation code `L-Galaxies`
    Departamento de Astronomía, Universidad de Concepción, Concepción, Chile

16. PUC astro-ph Seminar Series (*invited*, Nov 06, 2023)
    Nuclear star clusters: galaxy formation and evolution via NSC occupation statistics
    Instituto de Astrofísica, Pontificia Universidad Católica de Chile, Santiago de Chile, Chile

15. DIPC Seminar Series (*invited*, Oct 19, 2023)
Nuclear star clusters: a short introduction
Donostia International Physics Center, Donostia-San Sebastián, Spain

14. MPIA Galaxy Coffee (*invited*, Aug 17, 2023)
Investigating the presence of massive black holes in nuclear star clusters with SRG/eROSITA X-ray data
Max-Planck-Institut für Astronomie, Heidelberg, Germany

13. Connections between nuclear star clusters, black holes and galaxy evolution (Jul 07, 2023)
The mysterious nuclear star cluster of M 74
EAS 2023, Kraków, Poland

12. Stellar Populations Journal Club (*invited*, May 18, 2023)
The centre of the Phantom Galaxy with HST and JWST
John Moores University, Liverpool, England

11. Newcastle Journal Club (*invited*, May 16, 2023)
The centre of the Phantom Galaxy with HST and JWST
University of Newcastle, Newcastle, England

10. ZAH Teeminar (*invited*, Jan 31, 2023)
A combined HST and JWST analysis of the nuclear star cluster in NGC 628
Zentrum für Astronomie, University of Heidelberg, Heidelberg, Germany (remote)

9. MPIA Galaxy Coffee (*invited*, Jan 19, 2023)
A combined HST and JWST analysis of the nuclear star cluster in NGC 628
Max-Planck-Institut für Astronomie, Heidelberg, Germany (remote)

8. Durham FLAT (Nov 18, 2022)
A combined HST and JWST analysis of the nuclear star cluster in NGC 628
University of Durham, Durham, England

7. L-Galaxies Workshop (Nov 16, 2022)
Star clusters in L-Galaxies: the next few years
University of Hertfordshire, Hatfield, England

6. Origin, growth, and feedback of black holes in dwarf galaxies (Sep 15, 2022)
Nuclear star cluster properties unfold their formation mechanism in dwarf galaxies
Donostia International Physics Center, Donostia–San Sebastián, Spain

5. MPE High-Energy seminar (*invited*, Jul 25, 2022)
Nuclear star clusters: formation, evolution, and relation to black holes
Max-Planck-Institut für extraterrestische Physik, Garching bei München, Germany

4. MPIA Galaxy Coffee (*invited*, May 05, 2022)
Reinforcing the connection between globular clusters and nuclear star clusters in low-mass galaxies
Max-Planck-Institut für Astronomie, Heidelberg, Germany

3. L-Galaxies Workshop (Sep 12, 2021)
Nuclear star clusters: demographics, formation scenarios, and open questions
Donostia International Physics Center, Donostia–San Sebastián, Spain

2. MPIA Galaxy Coffee (Nov 05, 2020)
Does the nucleation fraction depend on environment?
Max-Planck-Institut für Astronomie, Heidelberg, Germany (remote)

1. Real-Time Analysis Trigger Meeting (Apr 05, 2019)
An inclusive trigger line for detached charm candidates
LHCb, CERN, Geneva, Switzerland (remote)

Conferences & Workshops

- *European Astronomical Society meeting 2023* (10. - 14. Jul 2023)
  Kraków Conference Center, Kraków, Poland
- *A multi-wavelength view on globular clusters near and far: from JWST to the ELT* (03. - 07. Jul 2023)
  Sexten Center for Astrophysics, Sesto, Italy
- *L-Galaxies workshop 2022* (16. - 17. Nov 2022)
  University of Hertfordshire, Hatfield, England
- *Young Astronomers on Galactic Nuclei* (17. - 19. Oct 2022)
  Donostia-San Sebastián, Spain
- *Origin, growth and feedback of black holes in dwarf galaxies* (12. - 16. Sep 2022)
  Donostia-San Sebastián, Spain

Supervision of students

- Diego Herrero Carrión (Summer internship) (Jun 2023 - Aug 2023)
  The globular cluster mass versus star formation correlation
  Donostia International Physics Center, Donostia-San Sebastián, Spain
- Franziska Bruckmann (Master Thesis) (May 2023 - today)
  The nuclear star cluster of NGC 1385 probed with HST *and* JWST
  Max-Planck-Institut für Astronomie, Heidelberg, Germany

Teaching

- Teaching assistant for "Physik A" (WT 2023/2024)
  Experimental physics for chemists and biologists
  Lecturer: Prof. Dr. Norbert Christlieb
- Teaching assistant for "Physik A" (WT 2022/2023)
  Experimental physics for chemists and biologists
  Lecturer: Prof. Dr. Norbert Christlieb
- Teaching assistant for "Physik B" (ST 2022)
  Experimental physics for chemists and biologists
  Lecturer: Prof. Dr. Norbert Christlieb
- Teaching assistant for "Einführung in die Astronomie 2" (ST 2022)
  Introduction to astronomy for physics students
  Lecturers: Dr. Dominika Wylezalek, Dr. Walter Dehnen

Skills

- Languages—German (native), English (C1 level), Spanish (basics), Latin (Examen Latinum)
- Operating systems—Linux, BSD, Windows
- Programming languages—C, C++, Fortran
- Scripting languagres—Python, Julia, vim, shell, awk, sed
- Markup languages—Latex, Markdown, groff
- Astronomical software—Topcat, Aladin, SAOImageDS9, IRAF, CIGALE, FSPS, various Python packages
- Others—git, gimp, pmwiki, ROOT

Miscellaneous

- Referee for *Astronomy & Astrophysics* (since 2023)
- Member of the PHANGS collaboration (since 2022)
- External collaborator of the eROSITA consortium (2022 - 2023)
- Member of the L-Galaxies Team (since 2021)
- Co-organizer of the Galactic Nuclei group meetings (since 2020)
- Member of the Deutsche Physikalische Gesellschaft (since 2014)

Academic references

In order:

- Dr. Nadine Neumayer <neumayer@mpia.de>
  Lise Meitner group leader and faculty member at the MPIA
  Max-Planck-Institut für Astronomie, Heidelberg, Germany
- Prof. Dr. Silvia Bonoli <silvia.bonoli@dipc.org>
  Ikerbasque Research Fellow and staff member at the DIPC
  Donostia International Physics Center, Donostia–San Sebastián, Spain
- Prof. Dr. Anil C. Seth <aseth@astro.utah.edu>
  Professor for Physics and Astronomy at the University of Utah
  University of Utah, Salt Lake City, USA
- Prof. Dr. Nate Bastian <nate.bastian@dipc.org>
  Ikerbasque Research Professor
  Donostia International Physics Center, Donostia–San Sebastián, Spain