Raphael E. **Hviding**

Postdoctoral Researcher | Max-Planck Institute for Astronomy | He/His

hviding@mpia.de • mpia.de/~hviding • +49 6221 528-322

TheSkyentist • 0000-0002-4684-9005 • rehviding

Research Interests: Active Galactic Nuclei, Data Science, (Slitless) Spectroscopy

Appointments

Max-Planck Institute for Astronomy **Heidelberg, DE**

Postdoctoral Researcher Sep. 2023 - pres.

- *RUBIES Team under Dr. Anna de Graaff*
  - *Stastistical analyses of Little Red Dots with JWST NIRSpec.*
- *Data Science Group under Dr. Ivelina Momcheva*
  - *Slitless Spectroscopic Reduction & Analysis for (Parallel) Extragalactic Surveys*
- *Collaborations: RUBIES, OutThere, 3D-DASH, and Euclid*

Education

University of Arizona **Tucson, AZ**

Ph.D., M.Sc. in Astronomy & Astrophysics Aug. 2023, Jan. 2021

- *Seeing Red: The Present and Future of mid-IR AGN Selection with Optical Spectroscopy*
- *Advisors: Professor Kevin N. Hainline & Professor Marcia J. Rieke*

Dartmouth College **Hanover, NH**

B.A. in Physics (High Honors), Mathematics, and Astronomy (Minor) Jun. 2018

- *Senior Honors Thesis under Professor Ryan C. Hickox*

Mentoring

MPIA Summer Internship **Heidelberg, DE**

Summer Intership Co-Mentor Jun. 2025 - Sep. 2025

- Co-advised a summer intern in their investigation of dwarf galaxies in NIRISS imaging.

Summer Intership Mentor Jun. 2024 - Sep. 2024

- Advised a summer intern in their investigation of obscured AGN candidate spectra.

NOAO Astronomy Teen Café **Tucson, AZ**

Graduate Student Guest and Discussion Leader Oct. 2018 - May. 2022

- Worked with high school students on astronomical coding exercises and college advice.

Project ASTRO **Tucson, AZ**

Astronomer Collaborator of a School Teacher Sep. 2018 - May. 2018

- Worked with a primary school teacher to plan astronomical lessons for the classroom.

Teaching

ASTR 400B: Theoretical Astrophysics: Galaxies and Cosmology **UArizona**

Teaching Assistant with Professor Dan Stark Spring 2021

– Led office hours, graded, and taught a lecture for an advanced undergraduate course.

ASTR 170B: Exploring our Universe **UArizona**

Teaching Assistant with Professor Ed Prather Spring 2023

– Participated in lesson activities and led office hours for a general-education course.

Workshops

AI Agents Tutorial **Jan. 2026**

– Tutorial on GAI in scientific workflows and integrations with IDEs and MPC servers.

Pixi Tutorial **Jan. 2026**

– Tutorial on cross-platform reproducible (Python) environment management.

HPC Workshop **Mar. 2024, 2025**

– Workshop covering parallelization (threading and multiprocessing), SLURM scripting, containers (Docker/Apptainer), and workflow managers (Snakemake).

Code Development

unite **Lead Developer**

Unified Numerical Integration Tool for spEctroscopy Python

– *Joint Spectroscopic Fitting with NumPyro and JAX.*

– *Used to jointly fit multiple (NIRSpec) dispersers while accounting for undersampling.*

GELATO **Lead Developer**

Galaxy/AGN Emission Line Analysis TOol Python

– *Optical Spectroscopic Fitting package with a focus on testing for AGN contributions.*

– *In use by the DESI Collaboration, a LEGA-C Collaboration project, Dr. Mar Mezcua's group at Institute of Space Sciences in Spain, and Dr. Kohei Ichikawa's group at Tohoku University.*

Grizli **Contributor**

Grism redshift & line analysis software for space-based slitless spectroscopy Python

– *Contributions specifically to improving performance and accuracy with NIRISS WFSS data.*

Programming: Python, Linux, IRAF, SQL, ADQL, HTML/CSS, git, LaTeX, SLURM

Press

Selected Media Coverage

Feb. 2026 Scientific American, *Weird new object escalates 'black hole star' debate*
Sep. 2025 Max-Planck-Gesellscahft, *Are Black Hole Stars real?*
Feb. 2020 University of Arizona, *On Student Success, This Astronomer Walks the Walk*
Dec. 2017 Dartmouth College, *Studying the Stars in the South African Sky*

Presentations

Invited Talks

Nov. 2025 Tel Aviv University, Astro Seminar Tel-Aviv, IL
May. 2024 MPIA, Königstuhl Colloquium Heidelberg, DE
Jun. 2024 Durham University, Special Talk Durham, UK

Workshops

Feb. 2026	ISSI Team 25-659	Bern, CH
Jan. 2026	CSI: Sesto	Sexten, IT

Conferences

Apr. 2026	PyCon DE & PyData 2026, Talk	Darmstadt, DE
May. 2025	Crisol 2025, Talk	Toledo, ES
Apr. 2025	PyCon DE & PyData 2025, Talk	Darmstadt, DE
Jan. 2025	Euclid GAEV Meeting, Talk	Tenerife, ES
Jan. 2023	AAS 241, Talk	Seattle, WA
Oct. 2022	SACNAS NDiSTEM 2022, Talk	San Juan, PR
Nov. 2018	Advances with SALT, Talk	Pretoria, SA
Sep. 2022	What drives the growth of black holes?, Poster	Reykjavík, IS
Jun. 2019	IAU Galaxies 2019, Poster	Viana do Castelo, PT
Nov. 2017	Ivy League Undergraduate Research Symposium, Poster	Philadelphia, PA
Aug. 2016	Hidden Monsters, Poster	Hanover, NH
Jun. 2016	Active Galactic Nuclei: What's in a name?, Poster	Garching, DE

Telescope Time

Principal Investigator

NOEMA W25	*Probing Exotic Dust and Gas Obscuration in a High-Redshift, X-Ray Luminous AGN* (10h; Grade A)
LBTO 2024B	*Seeing Double: A Survey of Dual and Lensed AGN at Cosmic Noon* (12h)
LBTO 2024A	*Seeing Double: A Survey of Dual and Lensed AGN at Cosmic Noon (Pilot)* (5h)
SAO 2023A	*Revealing Obscured SMBH Growth: Probing Type II AGN Candidates with MMT Binospec* with MMT Binospec (2 Nights)
SAO 2022B	*Uncovering the True Nature of the Kiloparsec-Scale Ionization in NGC 1068: Past AGN Activity or Shocks?* with MMT MMIRS and Bok BCSpec (1+3 Nights)
SAO 2021A	*MMIRS longslit follow-up of mid-IR AGN candidates with high Balmer Decrements: Obscured optical line emission?* with MMT MMIRS (1.5 Nights)
SAO 2020B	*Uncovering an Undiscovered Population of AGNs: Hectospec Follow-up of HSC-WISE-SDSS Matched Targets* with MMT Hectospec (2 Nights)

Co-Investigator

MPG 2.2m 117	*Cracking the Egg: Precision Variability of a Little Red Dot* (92h)
HST Cycle 34	*Beyond the Quasar Redshift Frontier: Uncovering Rapidly Accreting Supermassive Black Holes at $z > 8$ with HST/WFC3 and Euclid* (SNAP – 125 Orbits)
NOEMA W24	*Extremely compact galaxies at Cosmic Dawn: ultra-massive galaxies or AGN?* (16h; Grade A)

Honors & Awards

Awarded

2022	Departmental Graduate Student Award for Service	UArizona
2018 - 2023	National Science Foundation Graduate Research Fellowship	NSF
2018	College of Science Fellowship	UArizona
2018	International Travel Grant	AAS
2017 - 2018	E. E. Just Scholar	Dartmouth College

Publications

Eleven major contributing author publications: [**full list**]

(*eight as first/corresponding author)

[*1] **Raphael E. Hviding** et al., 2026, arXiv, arXiv:2601.09778, *The X-Ray Dot: Exotic Dust or a Late-Stage Little Red Dot?*

[2] Anna de Graaff, **Raphael E. Hviding** et al., 2025, arXiv, arXiv:2511.21820, *Little Red Dots host Black Hole Stars: A unified family of gas-reddened AGN revealed by JWST/NIRSpec spectroscopy*

[*3] **Raphael E. Hviding** et al., 2025, A&A, 702, A57, *RUBIES: A spectroscopic census of little red dots: All point sources with v-shaped continua have broad lines*

[*4] **Raphael E. Hviding** et al., 2024, AJ, 168, 220, *Improved Empirical Backgrounds for JWST NIRISS Image/Wide-field Slitless Spectroscopy Data Reduction*

[*5] **Raphael E. Hviding** et al., 2024, AJ, 167, 169, *Spectroscopic Confirmation of Obscured AGN Populations from Unsupervised Machine Learning*

[*6] **Raphael E. Hviding** et al., 2023, AJ, 166, 111, *The Kiloparsec-scale Influence of the AGN in NGC 1068 with SALT RSS Fabry-Pérot Spectroscopy*

[*7] **Raphael E. Hviding** et al., 2022, AJ, 163, 224, *A New Infrared Criterion for Selecting Active Galactic Nuclei to Lower Luminosities*

[8] Kevin N. Hainline, **Raphael E. Hviding** et al., 2020, ApJ, 892, 125, *Simulating JWST/NIRCam Color Selection of High-redshift Galaxies*

[9] L. Claire Gasque, Callum A. Hening, **Raphael E. Hviding** et al., 2019, AJ, 158, 156, *Two Long-period Cataclysmic Variable Stars: ASASSN-14ho and V1062 Cyg*

[*10] **Raphael E. Hviding** et al., 2018, ApJ, 868, 16, *Spatially Extended Low-ionization Emission Regions (LIERs) at $z \sim 0.9$*

[*11] **Raphael E. Hviding** et al., 2018, MNRAS, 474, 1955, *Characterizing the WISE-selected heavily obscured quasar population with optical spectroscopy from the Southern African Large Telescope*

36 total publications, twenty-five as contributing author:

[1] Bingjie Wang, …, **Raphael E. Hviding** et al., 2026, arXiv, arXiv:2602.06024, *Water absorption confirms cool atmospheres in two little red dots*

[2] Wendy Q. Sun, …, **Raphael E. Hviding** et al., 2026, arXiv, arXiv:2601.20929, *Little Red Dot − Host Galaxy = Black Hole Star: A Gas-Enshrouded Heart at the Center of Every Little Red Dot*

[3] Rohan P. Naidu, …, **Raphael E. Hviding** et al., 2026, OJAp, 9, 56033, *A Cosmic*

Miracle: A Remarkably Luminous Galaxy at zspec = 14.44 Confirmed with JWST

[4] Jenny E. Greene, ..., **Raphael E. Hviding** et al., 2026, ApJ, 996, 129, *What You See Is What You Get: Empirically Measured Bolometric Luminosities of Little Red Dots*

[5] Rodrigo Córdova Rosado, ..., **Raphael E. Hviding** et al., 2025, ApJ, 995, 227, *Cross-correlation of Luminous Red Galaxies with ML-selected Active Galactic Nuclei in HSC-SSP. II. AGN Classification and Clustering with DESI Spectroscopy*

[6] Anna de Graaff, ..., **Raphael E. Hviding** et al., 2025, A&A, 701, A168, *A remarkable ruby: Absorption in dense gas, rather than evolved stars, drives the extreme Balmer break of a little red dot at z = 3.5*

[7] Bingjie Wang, ..., **Raphael E. Hviding** et al., 2025, arXiv, arXiv:2508.18358, *The Missing Hard Photons of Little Red Dots: Their Incident Ionizing Spectra Resemble Massive Stars*

[8] Anna de Graaff, ..., **Raphael E. Hviding** et al., 2025, A&A, 697, A189, *RUBIES: A complete census of the bright and red distant Universe with JWST/NIRSpec*

[9] Andrea Weibel, ..., **Raphael E. Hviding** et al., 2025, ApJ, 983, 11, *RUBIES Reveals a Massive Quiescent Galaxy at z = 7.3*

[10] Olivia R. Cooper, ..., **Raphael E. Hviding** et al., 2025, ApJ, 982, 125, *RUBIES: JWST/NIRSpec Resolves Evolutionary Phases of Dusty Star-forming Galaxies at z ∼ 2*

[11] Ragadeepika Pucha, ..., **Raphael E. Hviding** et al., 2025, ApJ, 982, 10, *Tripling the Census of Dwarf AGN Candidates Using DESI Early Data*

[12] Rohan P. Naidu, ..., **Raphael E. Hviding** et al., 2025, arXiv, arXiv:2503.16596, *A "Black Hole Star" Reveals the Remarkable Gas-Enshrouded Hearts of the Little Red Dots*

[13] Charity Woodrum, ..., **Raphael E. Hviding** et al., 2024, PNAS, 121, e2317375121, *Using JADES NIRCam photometry to investigate the dependence of stellar mass inferences on the IMF in the early universe*

[14] Charity Woodrum, ..., **Raphael E. Hviding** et al., 2024, ApJ, 974, 305, *Active Galactic Nuclei in the Green Valley at z ∼ 0.7*

[15] Andrew J. Bunker, ..., **Raphael E. Hviding** et al., 2024, A&A, 690, A288, *JADES NIRSpec initial data release for the Hubble Ultra Deep Field: Redshifts and line fluxes of distant galaxies from the deepest JWST Cycle 1 NIRSpec multi-object spectroscopy*

[16] Morgan Fouesneau, ..., **Raphael E. Hviding** et al., 2024, arXiv, arXiv:2409.20252, *What is the Role of Large Language Models in the Evolution of Astronomy Research?*

[17] Kevin N. Hainline, ..., **Raphael E. Hviding** et al., 2024, ApJ, 964, 66, *Brown Dwarf Candidates in the JADES and CEERS Extragalactic Surveys*

[18] Kevin N. Hainline, ..., **Raphael E. Hviding** et al., 2024, ApJ, 964, 71, *The Cosmos in Its Infancy: JADES Galaxy Candidates at z > 8 in GOODS-S and GOODS-N*

[19] Jakob M. Helton, ..., **Raphael E. Hviding** et al., 2024, ApJ, 962, 124, *The JWST Advanced Deep Extragalactic Survey: Discovery of an Extreme Galaxy Overdensity at z = 5.4 with JWST/NIRCam in GOODS-S*

[20] Marcia J. Rieke, ..., **Raphael E. Hviding** et al., 2023, ApJS, 269, 16, *JADES Initial Data Release for the Hubble Ultra Deep Field: Revealing the Faint Infrared Sky with Deep JWST NIRCam Imaging*

[21] Daniel J. Eisenstein, ..., **Raphael E. Hviding** et al., 2023, arXiv, arXiv:2306.02465,

Overview of the JWST Advanced Deep Extragalactic Survey (JADES)

[22] B. E. Robertson, ..., **Raphael E. Hviding** et al., 2023, NatAs, 7, 611, *Identification and properties of intense star-forming galaxies at redshifts z > 10*

[23] Emma Curtis-Lake, ..., **Raphael E. Hviding** et al., 2023, NatAs, 7, 622, *Spectroscopic confirmation of four metal-poor galaxies at z = 10.3-13.2*

[24] Marcia Rieke, ..., **Raphael E. Hviding** et al., 2019, BAAS, 51, 45, *JWST GTO/ERS Deep Surveys*

[25] Wei Yan, ..., **Raphael E. Hviding** et al., 2019, ApJ, 870, 33, *NuSTAR and Keck Observations of Heavily Obscured Quasars Selected by WISE*