

# Raphael E. Hviding

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

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

## APPOINTMENTS

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<b>Max-Planck Institute for Astronomy</b>	<b>Heidelberg, DE</b>
Postdoctoral Researcher	Sep. 2023 - pres.
– <i>RUBIES Team under Dr. Anna de Graaff</i>	
– <i>Statistical analyses of Little Red Dots with JWST NIRSpec.</i>	
– <i>Data Science Group under Dr. Ivelina Momcheva</i>	
– <i>Slitless Spectroscopic Reduction &amp; Analysis for (Parallel) Extragalactic Surveys</i>	
– <i>Collaborations: RUBIES, OutThere, 3D-DASH, and Euclid</i>	

## EDUCATION

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<b>University of Arizona</b>	<b>Tucson, AZ</b>
Ph.D., M.Sc. in Astronomy & Astrophysics	Aug. 2023, Jan. 2021
– <i>Seeing Red: The Present and Future of mid-IR AGN Selection with Optical Spectroscopy</i>	
– <i>Advisors: Professor Kevin N. Hainline &amp; Professor Marcia J. Rieke</i>	
<b>Dartmouth College</b>	<b>Hanover, NH</b>
B.A. in Physics (High Honors), Mathematics, and Astronomy (Minor)	Jun. 2018
– <i>Senior Honors Thesis under Professor Ryan C. Hickox</i>	

## MENTORING

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<b>MPIA Summer Internship</b>	<b>Heidelberg, DE</b>
<i>Summer Internship Co-Mentor</i>	Jun. 2025 - Sep. 2025
– Co-advised a summer intern in their investigation of dwarf galaxies in NIRISS imaging.	
<i>Summer Internship Mentor</i>	Jun. 2024 - Sep. 2024
– Advised a summer intern in their investigation of obscured AGN candidate spectra.	
<b>NOAO Astronomy Teen Café</b>	<b>Tucson, AZ</b>
<i>Graduate Student Guest and Discussion Leader</i>	Oct. 2018 - May. 2022
– Worked with high school students on astronomical coding exercises and college advice.	
<b>Project ASTRO</b>	<b>Tucson, AZ</b>
<i>Astronomer Collaborator of a School Teacher</i>	Sep. 2018 - May. 2018
– Worked with a primary school teacher to plan astronomical lessons for the classroom.	

## TEACHING

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<b>ASTR 400B: Theoretical Astrophysics: Galaxies and Cosmology</b>	<b>UArizona</b>
<i>Teaching Assistant with Professor Dan Stark</i>	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

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### **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

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### **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, L<sup>A</sup>T<sub>E</sub>X, SLURM

## PRESS

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### **Selected Media Coverage .....**

Feb. 2026 [Scientific American](#), *Weird new object escalates ‘black hole star’ debate*

Sep. 2025 [Max-Planck-Gesellschaft](#), *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

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### **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

<b>Workshops</b>		
Feb. 2026	<a href="#">ISSI Team 25-659</a>	Bern, CH
Jan. 2026	<a href="#">CSI: Sesto</a>	Sexten, IT
<b>Conferences</b>		
Apr. 2026	<a href="#">PyCon DE &amp; PyData 2026</a> , Talk	Darmstadt, DE
May. 2025	<a href="#">Crisol 2025</a> , Talk	Toledo, ES
Apr. 2025	<a href="#">PyCon DE &amp; PyData 2025</a> , Talk	Darmstadt, DE
Jan. 2025	<a href="#">Euclid GAEV Meeting</a> , Talk	Tenerife, ES
Jan. 2023	<a href="#">AAS 241</a> , Talk	Seattle, WA
Oct. 2022	<a href="#">SACNAS NDiSTEM 2022</a> , Talk	San Juan, PR
Nov. 2018	<a href="#">Advances with SALT</a> , Talk	Pretoria, SA
Sep. 2022	<a href="#">What drives the growth of black holes?</a> , Poster	Reykjavík, IS
Jun. 2019	<a href="#">IAU Galaxies 2019</a> , Poster	Viana do Castelo, PT
Nov. 2017	<a href="#">Ivy League Undergraduate Research Symposium</a> , Poster	Philadelphia, PA
Aug. 2016	<a href="#">Hidden Monsters</a> , Poster	Hanover, NH
Jun. 2016	<a href="#">Active Galactic Nuclei: What's in a name?</a> , Poster	Garching, DE

## TELESCOPE TIME

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<b>Principal Investigator</b>		
NOEMA W25	<i>Probing Exotic Dust and Gas Obscuration in a High-Redshift, X-Ray Luminous AGN</i> (10h; Grade A)	
LBTO 2024B	<i>Seeing Double: A Survey of Dual and Lensed AGN at Cosmic Noon</i> (12h)	
LBTO 2024A	<i>Seeing Double: A Survey of Dual and Lensed AGN at Cosmic Noon (Pilot)</i> (5h)	
SAO 2023A	<i>Revealing Obscured SMBH Growth: Probing Type II AGN Candidates with MMT Binospec</i> with MMT Binospec (2 Nights)	
SAO 2022B	<i>Uncovering the True Nature of the Kiloparsec-Scale Ionization in NGC 1068: Past AGN Activity or Shocks?</i> with MMT MMIRS and Bok BC Spec (1+3 Nights)	
SAO 2021A	<i>MMIRS longslit follow-up of mid-IR AGN candidates with high Balmer Decrement: Obscured optical line emission?</i> with MMT MMIRS (1.5 Nights)	
SAO 2020B	<i>Uncovering an Undiscovered Population of AGNs: Hectospec Follow-up of HSC-WISE-SDSS Matched Targets</i> with MMT Hectospec (2 Nights)	
<b>Co-Investigator</b>		
MPG 2.2m 117	<i>Cracking the Egg: Precision Variability of a Little Red Dot</i> (92h)	
HST Cycle 34	<i>Beyond the Quasar Redshift Frontier: Uncovering Rapidly Accreting Supermassive Black Holes at <math>z &gt; 8</math> with HST/WFC3 and Euclid (SNAP – 125 Orbits)</i>	
NOEMA W24	<i>Extremely compact galaxies at Cosmic Dawn: ultra-massive galaxies or AGN?</i> (16h; Grade A)	

## HONORS & AWARDS

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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

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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  $z_{\text{spec}} = 14.44$  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  $z \sim 2$*
- [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  $z \sim 0.7$*
- [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  $z = 10.3\text{-}13.2$*
- [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*