# Dhruv Muley

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Citizenship: *United States*

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## Education and Appointments

**MPA Postdoctoral Fellow**, Max Planck Institute for Astrophysics, Garching bei München 2025—
Mentor: Prof. dr. Volker Springel
**Research Interests** numerical hydrodynamics, radiative transfer, exoplanets/protoplanetary disks

Generalizing PLUTO's 3T scheme to include multiple dust species, to better simulate dynamical and thermal physics in protoplanetary disks and reproduce observations in the mid-infrared and dust continuum. Also aiming to use the AREPO moving-mesh hydrodynamics code for protoplanetary disk applications.

**PhD Astrophysics**, Max Planck Institute for Astronomy, Heidelberg (Germany) 2021—
Advisor: apl. Prof. dr. Hubert Klahr
**Research Interests** numerical hydrodynamics, radiative transfer, exoplanets/protoplanetary disks

Developed and used "three-temperature" (3T) radiation hydrodynamics scheme for the PLUTO code, and applied it to simulations of protoplanetary disks. Used the Monte Carlo radiative transport (MCRT) tool RADMC3D to post-process simulations into near-infrared (NIR) and CO-isotopologue line observations.

**Research Assistant**, University of Victoria (British Columbia) 2020–21
Advisor: Prof. Ruobing Dong
**Research Interests** numerical hydrodynamics, radiative transfer, protoplanetary disks

**B.A. Physics, B.A. Astrophysics**, University of California, Berkeley 2016–20
Advisor: Dr. Jeffrey Fung
**Research Interests** numerical hydrodynamics, protoplanetary disks, galaxy evolution

## Publications

7 first-author, 1 second-author, 2 $n$th author research publications. For an up-to-date publication list, see my ADS library.

10. Melon Fuksman, Julio David; Flock, Mario; Klahr, Hubert; Mattia, Giancarlo; **Muley, Dhruv**. "Multidimensional half-moment multigroup radiative transfer. Improving moment-based thermal models of circumstellar disks," *Astronomy and Astrophysics*, 701, A97 (2025; arXiv:2408.16461)

9. **Muley, Dhruv**; Melon Fuksman, Julio David; Klahr, Hubert. "Spiral excitation in protoplanetary disks through gap-edge illumination: Three-temperature radiation hydrodynamics and NIR image modeling," *Astronomy and Astrophysics* (2024; arXiv:2408.16461)

8. **Muley, Dhruv**; Melon Fuksman, Julio David; Klahr, Hubert. "Three-temperature radiation hydrodynamics with PLUTO: Thermal and kinematic signatures of accreting protoplanets," *Astronomy and Astrophysics*, 687, A213 (2024; arXiv:2405.03375)

7. **Muley, Dhruv**; Melon Fuksman, Julio David; Klahr, Hubert. "Three-temperature radiation hydrodynamics with PLUTO: Tests and applications in the context of protoplanetary disks," *Astronomy and Astrophysics*, 678, A162 (2023; arXiv:2308.03504)

6. **Muley, Dhruv**; Dong, Ruobing. "CI Tau: A controlled experiment in disk-planet interaction," *The Astrophysical Journal Letters*, 921, 2 (2021; arXiv:2110.13182)

5. **Muley, Dhruv**; Wheeler, Coral; Hopkins, Philip; Wetzel, Andrew; Emerick, Andrew; Kereš, Dušan. "Progenitor-mass-dependent yields amplify intrinsic scatter in dwarf-galaxy elemental abundance ratios," *Monthly Notices of the Royal Astronomical Society*, 508, 1 (2021; ArXiv:2008.04901)

4. **Muley, Dhruv**; Dong, Ruobing; Fung, Jeffrey. "Observational signatures of planets in protoplanetary disks: Temperature structures in spiral arms," *The Astronomical Journal*, 162, 4 (2021; ArXiv:2107.06323)

3. van der Marel, Nienke and 9 others incl. **Dhruv Muley**. "On the diversity of asymmetries in gapped protoplanetary disks," *The Astronomical Journal*, 161, 33 (2021; arXiv:2010.10568)

2. Fung, Jeffrey; **Muley, Dhruv**. "A staggered semi-analytic method for simulating dust grains subject to gas drag," *The Astrophysical Journal Supplement Series*, 244, 2 (2019; ArXiv:1909.02006)

1. **Muley, Dhruv**; Fung, Jeffrey; van der Marel, Nienke. "PDS 70: A transition disk sculpted by a single planet," *The Astrophysical Journal Letters*, 879, 1 (2019; ArXiv:1902.07191)

## Talks and Conferences

8. "3T radiation hydrodynamics with PLUTO: A powerful tool to investigate protoplanetary disks"
   **Talk** at University of Arizona Steward Observatory (Tucson, AZ, USA) — September 10, 2024
   **Talk** at Princeton University (Princeton, NJ, USA) — October 29, 2024

7. "Can gap-edge illumination excite spirals in protoplanetary disks?"
   **Talk** at Leiden Observatory Lunch (Leiden, NL) — April 12, 2024
   **Poster** at Exoplanets 5 (Leiden, NL) — June 18, 2024
   **Poster** at New Heights in Planet Formation (Garching, DE) — July 17-19, 2024
   **Talk** at Minor Bodies of the Solar System (Ringberg, DE) — December 20, 2024

6. "Thermal and kinematic signatures of accreting protoplanets"
   **Talk** at PLUTO Symposium (Torino, IT) — September 25, 2024
   **Talk** at Columbia University (New York, NY, USA) — October 24, 2024
   **Poster** at MHD Flows in Young Circumstellar Disks (Ringberg, DE) — November 2-4, 2023

5. " Three-temperature radiative transfer for the PLUTO hydrodynamical code"
   **Talk** at Disks and Planets across ESO Facilities (Garching, DE) — November 29, 2022
   **Talk** at SPP 1992 meeting (München, DE) — March 15, 2023

4. "Observational signatures of planet formation: temperature structures from spiral arms"
   **Poster** at CASCA 2021 AGM (virtual) — May 8, 2021
   **Talk** at "The formation of the Solar System" (Ringberg, DE) — October 8, 2021

3. "Wide, deep cavities in gas and dust: simulations versus observations" — December 7-11, 2020
   **Talk** at Five years after HL Tau: a new era in planet formation (virtual)

2. "PDS 70: A laboratory for disk-planet interaction" — November 22, 2019
   **Talk** at Bay Area Planetary Science Meeting (Stanford)

1. "PDS 70: A transition disk sculpted by a single planet" — February 14, 2019
   **Talk** at Astronomy Thursday Lunch (UC Berkeley)

## Technical Skills

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| **Advanced** | Python, C/C++, Unix |
| **Intermediate** | CUDA, Java, Mathematica, LaTeX |
| **Basic** | Fortran 90, HTML, JavaScript, Photoshop, MPI |