Aayush Arya

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Education

Oct 2022 to Present	Master of Science – **Physics (Excellence Track)** **Johannes Gutenberg University of Mainz, Germany**
	Recipient of the Excellence Track scholarship for all 24 months of study. Relevant Courses: Theoretical Nuclear Physics, Machine Learning in Physics, Atomic Physics, Applications of Group Theory in Molecular Systems, Computer Simulations in Statistical Physics, The Search for Dark Matter, The Physics of Stars.
Jul 2019 to Jun 2022	Bachelor of Science (Honours) – **Physics**, CGPA: 8.49/10.0 **Lovely Professional University, Phagwara, India**
	Dissertation: "The chemistry and kinematics of the Sagittarius dwarf galaxy". Results presented at IAU General Assembly (see Posters). Advisors: **Dr. Andrew McWilliam**, **Dr. Shankar D. Pathak**. Class Rank: 1/15.

Research Experience

Oct 2023 to Present	**Helmholtz Institute Mainz**, Germany Master's Thesis Student
	I'm working on a newly-commissioned laser spectroscopy technique with a novel detection method that doesn't rely on fluorescence. I have successfully measured the hyperfine structure and isotope shift between the ^{175}Lu and ^{176}Lu isotopes, demonstrating that our derived values are fully consistent with values from tradiational methods. I'm presenting my results at the DPG Spring Meeting on AMO Physics Advisor: **Dr. Mustapha Laatiaoui**
May 2022 to July 2022	**Chalmers University of Technology**, Gothenburg, Sweden Research Intern, Chalmers Astrophysics and Space Science Summer Fellow
	I studied outflows from the AGB star W Hya using multi-epoch imaging and spectroscopy with ALMA at sub-mm wavelengths. I found clear changes in the kinematic and spatial structure of molecular transition lines in SiO and CO, and modelled them using a radiative transfer code. Advisors: **Dr. Theo Khouri** and **Dr. Wouter Vlemmings**.
May 2021 to May 2022	**Observatories of the Carnegie Institution for Science** Research Intern & Bachelor's Thesis Student
	I measured abundances of 12 elements including iron-peak and neutron-capture elements (La, Ba, Eu) of stars in the Sagittarius dwarf galaxy (Sgr). I found a deficiency of Ni in Sgr stars compared to the Milky Way, suggesting that sub-Chandrasekhar mass type Ia supernovae must've dominated the chemical enrichment of Sgr. The project began as a summer project (see Summer Report), and I extended it to my bachelor's thesis to investigate questions about chemical inhomogeneities and spatial variation. Advisor: **Dr. Andrew McWilliam**.
May 2020 to Dec 2020	Research Associate, **Blue Marble Space Institute of Science** Young Scientist Program, 2020
	I simulated reaction networks of complex chemistries to create a "map" for searching for unidentified compounds in meteorite samples, using graph theory based chemistry packages. I wrote the majority of the code (see repository). I was able to reproduce species reported in the literature, and assign mass peaks from our FT-ICR mass spectra (see Arya *et al.* (2022) in Publications). Advisor: **Dr. Henderson Cleaves**.

Grants & Scholarships

May 2022	International Astronomical Union Travel Grant Awarded 800€ for presenting at the 31st IAU General Assembly.
Mar 2022	Korean Astronomical Society Grant for attending the 31st IAU General Assembly Endorsed by IAU Member **Dr. Ian Roederer** (University of Michigan). This grant covered the 318€ registration and boarding expenses (∼$100/night) for up to 11 nights.
Mar 2022	Excellence Track Scholarship of JGU Mainz I was awarded a 934€ per month scholarship for the 24-month period of my master's studies in the *Excellence Track* program.
Mar 2022	Chalmers Astrophysics and Space Science Summer Research Fellowship I was one of the 11 students out of hundreds of applicants worldwide selected for the CASSUM fellowship.

Publications

Articles

- **Arya, A.**, *et al.* (2022). "An open source computational workflow for the discovery of autocatalytic networks in abiotic reactions". *Chemical Science*, **13**, 4838-4853. https://doi.org/10.1039/D2SC00256F
- Sharma, S., **Arya, A.**†, Cruz, R.†, Cleaves II, H.J. (2021). "Automated Exploration of Prebiotic Chemical Reaction Space: Progress And Perspectives". *Life*, **11**, 1140. https://doi.org/10.3390/life11111140

† These authors contributed equally.

Posters‡

‡ A selection of the complete list.

- **Arya, A.** *et al.*, "Hyperfine structure of neutron-capture elements measured via a novel electronic state chromatography", 19th Russbach School on Nuclear Astrophysics. March 2024.
- **Arya, A.**, McWilliam, A. "Elemental abundances in the Sagittarius dwarf galaxy: Evidence for sub-Chandrasekhar mass type Ia supernovae, s-process enhancement". *XXXI IAU General Assembly*.
- **Arya, A.**, *et al.*, "In-silico modelling of reaction networks involved in meteorite chemistry to understand the origin of life". *43rd COSPAR Scientific Assembly*. Jan 28 – Feb 4, 2021 (Virtual).

Oral Presentations

Mar 2024	German Physical Society (DPG) Spring Meeting on Atomic Molecular & Optical Physics "Hyperfine structure of a Lawrencium homologue via Laser Resonance Chromatography".
Jul 2022	CASSUM-VICO Student Symposium, Chalmers University of Technology "The inner dusty envelope of an AGB star resolved with ALMA: Temporal variations in W Hya".
Aug 2021	Near Field Cosmology / Galactic Chemical Evolution Journal Club, MIT Contributed Talk: "Chemical abundance patterns in the Sagittarius dwarf galaxy".
Aug 2020	BlueSciCon II of the Blue Marble Space Institute of Science, 2020 Contributed Talk: "Simulating chemical reaction networks involving life-essential molecules".

Achievements & Honours

Jun 2019	Finalist, MediData and Regeneron Genomics Challenge I led a team that was invited to present a *featured* poster at the Global STEM Alliance Summit.
Nov 2018	Molecular Frontiers Inquiry Prize For describing a problem of scientific/social impact in molecular sciences.

Professional Societies

2021 – 2022	Member, American Physical Society
2019 – 2020	Student Member, New York Academy of Sciences
2018 – 2019	Young Member, New York Academy of Sciences

Computer Languages & Skills

Python, Java, Kotlin, LaTeX.
Machine learning with TensorFlow/Keras; IRAF, MOOG, Linux, Git.

References

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