Shyam Harimohan Menon

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Education & Research Experience

Oct. 2019 – present
Doctor of Philosophy, *Astronomy & Astrophysics*,
Research School of Astronomy & Astrophysics, Australian National University, Canberra, Australia
Thesis title: Impacts of Stellar Feedback on Star Formation
Advisors: A/Prof. Christoph Federrath & Prof. Mark Krumholz

Aug. 2014 – May 2019
Integrated Bachelor and Master of Technology (Hons.), *Engineering Physics*,
Department of Physics, Indian Institute of Technology (BHU), Varanasi, India
Thesis title: HI Fragmentation in the Turbulent Interstellar Medium
Advisor: A/Prof. Prasun Dutta

May 2018 – August 2019
Summer Research Scholar,
University of Tübingen,
Tübingen, Germany
Project title: Impact of ionising radiation on the turbulent ISM
Advisor: Dr. Rolf Kuiper

May 2017 – August 2017
MITACS Globalink Summer Internship,
University of Western Ontario,
London, Canada
Project title: Numerical Magneto-hydrodynamic simulations with the Athena code
Advisor: Prof. Shantanu Basu

Research Projects

August 2020 – present
Impact of Radiation Feedback on Star Cluster Formation,
Primary Collaborators:A/Prof. Christoph Federrath & Prof. Mark Krumholz

- Developed `VETTAM`[1], a novel radiation-hydrodynamics module with Adaptive-Mesh Refinement in the `FLASH` code, to study the effects of radiation on star cluster formation. [Publication # 2]
- Using `VETTAM`, we tested the role of radiation pressure from dust-reprocessed infrared photons on regulating star formation and driving winds in super-star cluster environments. [Publication # 1]
- Currently testing the cumulative effects of radiative feedback mechanisms using multi-band RHD simulations, and constraining the conditions in which feedback fails to regulate star formation.

[1] Variable Eddington Tensor closed Transport on Adaptive Meshes (VETTAM)

August 2019 – May 2021 **Impact of ionising radiation feedback on the turbulent interstellar medium (ISM)**,
Primary Collaborators: A/Prof. Christoph Federrath, Dr. Rolf Kuiper, Dr. Pamela Klaassen, Piyush Sharda

- Probed the effects of ionising radiation on driving compressive turbulence and potentially triggering star formation in the ISM using numerical simulations. [Publication # 6]
- Tested the hypothesis of the above study observationally by quantifying the bulk properties of the turbulence in the Carina nebula. [Publication # 5]
- Extended the methodology of the previous study to quantify the dynamical effects of physical mechanisms on turbulence in the LMC. [Publication # 3]
- Currently studying the role of ionising radiation in shaping the magnetic fields in star-forming gas.

September 2020 – Present **The Spatial Distribution of Star Clusters in External Galaxies**,
Primary Collaborators: Dr. Kathryn Grasha, Prof. Bruce G. Elmegreen, Prof. Daniela Calzetti, Dr. Angela Adamo

- Investigated the fractal distribution of young star clusters in 12 local galaxies with the LEGUS survey. [Publication # 4]
- Currently extending work to probe the star cluster distributions in local high-redshift analogue galaxies with the HiPEEC survey, and a larger sample of local galaxies with the PHANGS survey.

Honors & Grants

Oct 2021 ANU Olin J Eggen Research Award for excellence in research ($2500 AUD)

March 2022 RSAA Travel Grant ($5000 AUD)

Oct 2019 ANU PhD Scholarship ($29000 AUD p.a.)

Oct 2019 ANU RSAA Supplementary Research Scholarship ($ 2500 AUD p.a.)

August 2018 Graduate Aptitude Test in Engineering (GATE) Postgraduate Scholarship

May 2018 Eberhard Karls Universität Tübingen Summer Research Stipend

May 2017 Mitacs Globalink Research Internship Award

April 2013 Kishore Vaigyanik Protsahan Yojana (KVPY) Scholarship

Teaching and Mentorship

Feb 2022 – present **Teaching Assistant, ASTR 1003 – Astronomy & Space**,
Respond to student queries on the course forum and assist in tutorials

Dec 2021 – Feb 2022 **Mentor: Hank Hua (ANU undergraduate student)**,
Project title: Effects of spiral arms on the Two Point Correlation Function

March 2021 – present **Mentor, McNamara-Saunders Astronomical Teaching Telescopes Project**,
Mentored a grade 10 high school student on a project to measure the period of the l-Carinae Cepheid-variable star. Currently working with a second student on exploring galaxy morphology with photometry.

Aug 2018 – Dec 2018 **Teaching Assistant, PHY 1002 – Introduction to Engineering Electromagnetics**,
Duties involved one tutorial session per week and assistance in preparing tutorials for this undergraduate course

Jan 2018 – May 2018 **Teaching Assistant, PHY 304 – Computational Physics**,
Duties involved one laboratory session per week, assisting students in implementing numerical methods and recipes taught in theory classes.

March 2022 – present **Tutor, Canberra Tutors – High School Mathematics and Physics**,
Conduct private tutorial sessions for grade 11 & 12 students for their physics and mathematics coursework..

Synergistic Activities

May 2022 – present **Member, PHANGS Collaboration**,
Working with the PHANGS collaboration on quantifying how star formation is distributed in galaxies.

Feb 2022 – present **Chair, Seminars Commitee, RSAA**,
Heading the seminars team; responsible for organising, hosting and inviting speakers for colloquia

July 2021 – present **Reviewer, Monthly Notices of the Royal Astronomical Society (MNRAS)**,
Total Reviewed Papers: 2

Sept 2020 – Feb 2022 **Member of Seminars Commitee, RSAA**,
Hosted >30 external colloquia and seminars at RSAA

Jan 2020–present **Member, Astronomical Society of Australia (ASA)**,
Active student member of the ASA, and its theoretical astrophysics working group ANITA.

Jan 2020–present **Student Representative, Work, Health & Safety Committee, RSAA**,
Formally representing the student cohort in ensuring a safe and healthy workplace.

Sep 2021 – present **Standard Mental Health First Aider (MHFA)**,
Accredited MHFA by Mental Health First Aid Australia

Aug 2017 – Nov 2017 **Organising Core Team Member, Jigyasa 2017**,
Core team member in organising Jigyasa, the annual physics convention held at the Department of Physics, IIT(BHU) Varanasi

Publications

1. Infrared Radiation Feedback Does Not Regulate Star Cluster Formation or Drive Winds [1 Citation]
   Menon, S.H., Federrath, C. & Krumholz, M.R, MNRAS, submitted, June 2022
2. VETTAM: A scheme for radiation hydrodynamics with adaptive mesh refinement using the variable Eddington tensor method [3 Citations]
   Menon, S.H., Federrath, C., Krumholz, M.R, Kuiper, R., Wibking, B.D, Jung, M., 2022, MNRAS, 512, 401
3. First extragalactic measurement of the turbulence driving parameter: ALMA observations of the star-forming region N159E in the Large Magellanic Cloud [7 Citations]
   Sharda, P., **Menon, S.H.**, Federrath, C., Krumholz, M. R., Beattie, J. R., Jameson, K. E., Tokuda, K., Burkhart, B., Crocker, R. M., Law, C. J., Seta, A., Gaetz, T. J., Pingel, N. M., Seitenzahl, I. R., Sano, H., and Fukui, Y., MNRAS, 509, 2180
4. The dependence of the hierarchical distribution of star clusters on galactic environment [4 Citations]
   Menon, S.H., Grasha, K., Elmegreen, B.G., Federrath, C., Krumholz, M.R., Calzetti, D., Sánchez, N., Linden, S.T., Adamo, A., Messa, M., Cook, D.O., Dale, D.A., Grebel, E.K., Fumagalli, M., Sabbi, E., Johnson, K.E., Smith, L.J., Kennicutt, R.C., 2021, MNRAS, 507, 5542
5. On the compressive nature of turbulence driven by ionizing feedback in the pillars of the Carina Nebula [11 Citations]
   Menon, S.H., Federrath, C., Klaassen, P., Kuiper, R., Reiter, M., 2021, MNRAS, 500, 1721
6. On the turbulence driving mode of expanding H II regions [13 Citations]
   Menon, S.H., Federrath, C., Kuiper, R., 2020, MNRAS, 493, 4643

Conference Presentations & Colloquia

October 2022 **CCAPP Seminar, Ohio State University**,
Title: Role of stellar feedback in extreme environments

September 2022 **SFIR Seminar, Princeton University**,
Title: Radiation Feedback in Star Cluster Formation and Evolution

August 2022 **Contributed Talk - Star Formation in Different Environments, Quy Nhon, Vietnam**,
Title: The dynamical role of radiation pressure in the turbulent ISM

July 2022 **Contributed Talk - A Holistic View of Stellar Feedback and Galaxy Evolution, Ascona**,
Title: The role of radiation pressure in dense stellar systems

July 2022 **Planet and Star Formation (PSF) Seminar - Max-Planck-Institut for Astronomy, Heidelberg**,
Title: Radiation Feedback in Star Cluster Formation

June 2022 **Seminar - Centre de Recherche Astrophysique de Lyon (CRAL)**,
Title: Radiation Feedback in Star Cluster Formation

June 2022 **Star Formation Seminar - CEA, Saclay**,
Title: Radiation Feedback in Star Cluster Formation

June 2022 **Poster - From Stars to Galaxies II, Gothenburg**,
Title: The inability of radiation pressure to regulate star formation

June 2022 **Contributed Talk - NBIA Workshop on Radiation Transfer in Astrophysics, Copenhagen**,
Title: Modelling radiation hydrodynamics with the VET method

Dec 2021 **Invited Colloquium - Indian Institute of Astrophysics, Bangalore**,
Title: The interplay of stellar feedback and turbulence in the ISM

Nov 2021 **Contributed Talk, IAU Symposium 362 - The Predictive Power of Computational Astrophysics**,
Title: VETTAM - A novel algorithm for modelling radiation hydrodynamics

May 2021 **Contributed Talk, ISM 2021, Beirut - Structure, Characteristic Scales, and Star Formation**,
Title: Spatial distribution of star clusters in external galaxies

February 2021 **Contributed Talk, Australian National Insitute for Theoretical Astrophysics science workshop**,
Title: Compressive Turbulence Driven by Ionising Radiation in the ISM

September 2020 **Contributed Talk, Annual meeting of the Astronomische Gesellschaft, Germany**,
Title: Compressive Turbulence Driven by Ionising Radiation

March 2020 **Invited Talk, Modelling High-Mass Stellar Feedback Workshop, Tübingen, Germany**,
Title: Turbulence and Triggered Star Formation in Star Clusters

January 2020 **Australian National Insitute for Theoretical Astrophysics science workshop**,
Title: Turbulence Driving Mode of Expanding HII regions

Relevant Skills

Languages:, English, Malayalam, Tamil, Hindi, Sanskrit

Programming Experience:, C, C++, Fortran, Python, Mathematica, Bash

Codes/Softwares:, `FLASH`, `PLUTO`, `PETSc`, `Hypre`, `Athena`, `yt`, `CUDA`

Voluntary Training:, Mental Health First Aid, Understanding and Responding to Sexual Violence