# ARAVIND K

**Post-Doctoral Fellow**
**Physical Research Laboratory**
**(Unit of Dept. of Space, Govt. of India)**
**Thaltej, Ahmedabad, Pin : 380054**
**Phone: +079 26314507**
**Email : aravindk@prl.res.in**

## PERSONAL DATA

**Place | Date of Birth:** Kerala, India | 11 March 1992
**Address:** 49/728K Krishnageetham, Elamakkara,
Ernakulam, Kerala, India, Pin: 682026
**Phone:** +91 9895495214
**Email:** aravind139@gmail.com

## EDUCATION

**July 2017 - July 2022** **PhD in Astronomy & Astrophysics**, PRL, Ahmedabad, India
Thesis title - "Observational analysis of Cometary bodies in the Solar system."

**July 2013 - May 2015** **Master of Science in Physics**, Loyola College, Chennai, University of Madras, India
Thesis: "Wet Chemical Synthesis and Characterization of CdS Nanoparticles"
Advisor: Assistant Professor Dr. N. S. Nirmala Jothi
Gpa: 8.29/10

**July 2010 - June 2013** **Bachelor's in Science with honours in Physics**, Sacred Heart College, Thevara, Mahatma Gandhi University, Kottayam, Kerala
Gpa: 3.49/4

**June 2010** **Class XII** Central Board of Secondary Education, Kerala, India
Percentage: 89/100

**June 2008** **Class X** Central Board of Secondary Education, Kerala, India
Percentage: 92/100

## AWARDS AND FELLOWSHIPS

**Sept. 2022 - Present** Post-Doctoral Fellow, Physical Research Laboratory, Ahmedabad
**July 2019 - July 2022** Senior Research Fellow, Physical Research Laboratory, Ahmedabad
**2017 - July 2019** Junior Research Fellow, Physical Research Laboratory, Ahmedabad
**2017** Qualified for Junior Research Fellowship (JRF) in CSIR-UGC NET JUNE 2017
**2017** Qualified Joint Entrance Screening Test (JEST), All India Rank : 236
**2017** Qualified GATE exam in Physics, All India Rank : 419
**2016** Qualified for Lectureship in CSIR-UGC NET DEC 2016
**2013 - 2015** Gold Medal - MSc. Physics Batch topper, Loyola College, Chennai
**2013 - 2014** Gold Medal - M.Sc. Physics 1st and 2nd Semester batch topper, Loyola College, Chennai

## TECHNICAL SKILLS

**Programming Languages and Softwares :** Basic Knowledge in C++, C, html and proficient in IRAF, Python, LaTeX, Beamer
**Telescope Observations :** Hands-on experience with 3.6 m, 2.5 m, 2 m, 1.2 m, 50 cm and 43 cm telescopes.
**Accepted Telescope proposals:** Multiple proposals on the 1.2 m, 2 m and 3.6 m Indian Telescopes. Two proposals with the space telescope ASTROSAT (first comet observation on this facility). One Rank B accepted proposal in the Subaru telescope for mid-IR observation of comets with the COMIC instrument during the service period.
**Instruments Used :** LISA Spectrograph, Optical CCD imagers, NICSPol, Optical Polarimeter, HFOSC(Low-res), HESP(High-res), ADFOSC(Low-res), TANSPEC(NIR), UVIT.
**Astronomical observations performed :** Spectroscopy, Photometry and Polarimetry of comets.
**Computer OS :** Ubuntu, macOS, Windows

# RESEARCH EXPERIENCES

- **MSc course**: Project titled "Wet Chemical Synthesis and Characterization of CdS Nanoparticles", under the guidance of Dr N. S. Nirmala Jothi, Assistant Professor, Loyola College.
- **PhD course work 1st semester**: Project titled "Stability analysis of optical spectrograph used in the 1.2m Telescope at Mt.Abu", under the guidance of Dr Shashikiran Ganesh, Physical Research Laboratory, Ahmedabad. This project involved the extensive use of Image Reduction and Analysis Facility (IRAF) to reduce and analyse spectroscopic data to get a rough picture of the telescope's and detector's stability during observations.
- **PhD course work 2nd semester**: Project titled "Extraction and Flux calibration of Hanle Faint Object Spectrograph Camera (HFOSC) data", using IRAF, under the guidance of Dr Shashikiran Ganesh, Physical Research Laboratory, Ahmedabad.
- **PhD summer semester**: Project titled "Measuring Star Brightness : Aperture Photometry", using self-developed Python code under the guidance of Dr Vishal Joshi, Physical Research Laboratory, Ahmedabad.
- **PhD summer semester**: Project titled "Evaluating the thickness of astrochemical ice analogs" under the guidance of Dr Bhalamurugan Sivaraman, Physical Research Laboratory, Ahmedabad.
- **PhD Thesis**: Observational analysis of Cometary bodies in the Solar System. Comets, the most primordial remnants of our Solar system, can provide us with immense details regarding the conditions that prevailed during the initial stages. Indian telescopes were utilised for performing low-resolution spectroscopy of 22 comets (including comets from different reservoirs and the interstellar comet 2I/Borisov). High-resolution spectroscopic, imaging, and polarimetric observations were also conducted on a few comets to study these bodies containing pristine volatile materials. The results extracted from these observations were used to learn more about the molecules present, their production rate, column density, dust-to-gas ratio, dust grain parameters, Ortho-to-Para ratio of $NH_2$, Green-to-Red doublet ratio of forbidden Oxygen line etc. Further information like the relative molecular abundance or line ratios and their behaviour with heliocentric distances were extracted to realise the individual comet's composition and to get a collective understanding of the variations.
- **Post-Doctorate**: Further comets were followed in optical imaging and spectroscopy (low and high resolution). To extend expertise into different wavelength regimes, the TANSPEC instrument mounted on the 3.6 m DOT telescope in India was used to study comets in the IR regime. Even though the unavailability of windows above 2.5 $\mu m$ restricts us from directly observing the emissions from molecular gases, these observations are being used to analyse the continuum emission to probe the dust particles in detail. The possibility of using the existing observed data set to detect hidden ionic emissions and to compute a new set of parent and daughter scale lengths for different molecules is being explored.

# CONFERENCES/SEMINARS/SUMMER SCHOOLS ATTENDED

| | |
|---|---|
| **May 2014:** | Introductory Summer School on Astronomy and Astrophysics conducted by Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India. |
| **December 2014:** | Workshop on 'Recent Developments in Cosmology' conducted by IUCAA Resource Centre (IRC). Kochi, India. |
| **September 2018:** | Attended National level students conference, Young Astronomers Meet (YAM), Physical Research Laboratory (PRL), Ahmedabad, India. |
| **August 2019:** | Selected for $5^{TH}$ *Indo-French Astronomy School* on *Spectroscopy and Spectrographs* to be held in IUCAA, Pune, India from August 16 - 24, 2019. |
| **February 2020:** | Delivered a talk titled 'Contrasting behaviour of two Jupiter family comets' at the 38th Meeting of the Astronomical Society of India held at IISER Tirupati, between 13th - 17th February 2020. |
| **August 2020:** | Delivered a talk titled *'Spectroscopic and Imaging study of the first interstellar comet 2I/Borisov'* at the International Conference on Dust in Astrophysics held at Assam University, between $31^{st}$ August - $1^{st}$ September 2020. |
| **September 2020:** | Selected to present a poster titled *'Spectroscopic and Imaging study of first Interstellar comet 2I/Borisov from two Indian Observatories'* at the Poster exhibition held by the Royal Astronomical Society (RAS) on, $14^{th}$September 2020. |
| **February 2021:** | Selected to present a poster titled 'Spectroscopy, polarisation and dust modelling of *short period comet 156P/Russel-Linear'* at the Indian Planetary Science Conference (IPSC-2021), which was organised online during 25-26 February 2021. |
| **June 2021:** | Invited to deliver a talk on the *'Minor bodies in the Solar system'* by the Department of Physics, School of Applied Sciences, REVA University, Bangalore, during the occasion of 'World Asteroid Day 2021' on June $30^{th}$, 2021. |
| **March 2022:** | Selected to present a poster titled *'Optical polarimetric study of cometary dust'* at the $40^{th}$ Meeting of the Astronomical Society of India held at ARIES, Nainital, between $25^{th}$ - $29^{th}$ March 2022. |
| **September 2022:** | Selected to deliver a talk titled *'Polarimetric observation of cometary bodies'* at the $7^{th}$ SCOP conference held in PRL, Ahmedabad between $28^{th}$ - $30^{th}$ September 2022. |

**September 2022:** Selected to deliver a talk titled *'High resolution optical spectroscopic comparison of a short period and long period comet'* at the Europlanet Science Congress 2022, held in Granada, Spain. The abstract was withdrawn later due to travel budget issues.

**March 2023:** Selected to deliver a talk titled 'Peculiar long period comet C/2019 L3 observed from Indian and Belgian facilities' at the $41^{st}$ Meeting of the Astronomical Society of India held at IIT Indore, between $1^{st}$ - $5^{th}$ March 2023.

**March 2023:** Selected to deliver a talk titled 'Optical spectroscopy of comets' at the $3^{rd}$ BINA conference held at Graphic era Hill University, hosted by ARIES, Nainital, between $22^{nd}$ - $24^{th}$ March 2023.

**June 2023:** Selected to present a poster titled 'Revealing the ionic emissions in comet C/2020 F3 (NEOWISE)' at the $14^{th}$ ACM conference held at Flagstaff, Arizona, between $18^{th}$ - $23^{rd}$ June 2023.

# PUBLICATIONS

## Peer-Reviewed

1. **K. Aravind**, Shashikiran Ganesh, Kumar Venkataramani, Devendra Sahu, Dorje Angchuk, Thirupathi Sivarani, Athira Unni, *"Activity of the first interstellar comet 2I/Borisov around perihelion: results from Indian observatories"*, Monthly Notices of the Royal Astronomical Society, Volume 502, Issue 3, April 2021, Pages 3491–3499.
2. **K. Aravind**, Halder, P., Ganesh, S., et al. 2022, *"Optical observations and dust modelling of comet 156P/Russell-LINEAR"*, Icarus, 383, 115042.
3. Bhatt M., Wöhler C., Rogall J., **K. Aravind**., Ganesh S., Bharadwaj A., 2023, *"Unique regolith characteristics of the Reiner Gamma swirl as revealed by imaging polarimetry at large phase angles"*, A&A.
4. **K. Aravind**, Kumar Venkataramani, Shashikiran Ganesh, Thirupathi Sivarani, Athira Unni, Devendra Sahu, *"High resolution spectroscopy of comets using Hanle Echelle Spectrograph (HESP)"*, Submitted to MNRAS.

## Conference proceedings

5. Ganesh, Shashikiran, **Aravind Krishnakumar**, Kumar Venkataramani, Archita Rai, Kiran Singh Baliyan, and Umesh Chandra Joshi. *"Solar system studies with the Indo-Belgian telescopes."* Bulletin de la Société Royale des Sciences de Liège (2019).
6. Ganesh, S., Rai, A., **Aravind, K.**, Singh, A., Prajapati, P. V., Mishra, A., ... & Joshi, U. C. (2020, December). *"EMPOL: an EMCCD based optical imaging polarimeter."* In Ground-based and Airborne Instrumentation for Astronomy VIII (Vol. 11447, p. 114479E). International Society for Optics and Photonics.
7. Bhatt M., Wöhler C., **Aravind K.**, Ganesh S., Bharadwaj A., *"Regolith Characteristics of the Reiner Gamma Swirl as Revealed by Polarimetric Observations"*, 2021, LPI.
8. **K. Aravind**, Shashikiran Ganesh, *'Optical spectroscopy of comets'*, submitted as conference proceedings for BINA 2023 to be published in Bulletin of Liege Royal Society of Sciences.

## Astronomers Telegram

8. **Krishnakumar, A.**, Angchuk, D., Venkataramani, K., et al. 2020, *"CN, C2, C3 production rates of Comet C/2020 F3 (NEOWISE) as observed from Himalayan Chandra Telescope, Hanle"*, India, The Astronomer's Telegram, 13897, 1

# REFERENCES


1) **Prof. Shashikiran Ganesh**
Physical Research Laboratory,
(Unit of Dept. of Space, Govt. of India)
Ahmedabad - 380009, Gujarat, India
Email : shashi@prl.res.in

2) **Prof. Santosh Vadawale**
Physical Research Laboratory,
(Unit of Dept. of Space, Govt. of India)
Ahmedabad - 380009, Gujarat, India
Email : santoshv@prl.res.in

3) **Prof. Sivarani Thirupathi**
Indian Institute of Astrophysics,
Bangalore - 560034, Karnataka, India
Email : sivarani@gmail.com