Koshvendra Singh

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Integrated-PhD,
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Education

Current (2022-2025) - Integrated PhD, Department of Astronomy and Astrophysics, TIFR, Mumbai. The title of the thesis is 'Understanding the early phases of Low- and High-mass star formation'.

M.Sc. in Astronomy (2019-2022) - Department of Astronomy and Astrophysics, TIFR, Mumbai. Passed in first class with distinction, 7.5 CGPA. Master's projects titled 'Understanding spectroscopic analysis in Near- and Far-Infrared' and 'Optical and Near-infrared photometric study of LDN1415-IRS (IRAS 04376+5413)'.

B.Sc. (Physics Hons., 2016-2019) - Department of Physics, Banaras Hindu University, Varanasi. Passed in first class with distinction, 8.73 CGPA

Intermediate (2015-2016) - St. Mary's Higher Secondary School, Chakghat, Rewa, India. Passed in first class with distinction, 89%

High School (2013-2014) - St. Mary's Higher Secondary School, Chakghat, Rewa, India. Passed in first class with distinction, 91.3%

National Exams

- **IIT-JAM 2019** (Indian Institute of Technology - Joint Admission Test for Masters) - Secured All India Rank 92.
- **JEST 2019** (Joint Entrance Screening Test) - Secured All India rank 73
- **NGPE 2019** (National Graduate Physics Examination) - Among the top 1% on the National List

Scholarships and Awards

1. The Astronomical Society of India awarded me an `***Honorable Mention for the Young Astronomers Award for the Best Publication of the Year 2024***'.
2. I was awarded the prestigious *International Travel Scheme, Science and Engineering Research Board (SERB), Government of India, 2024*. I was awarded for presenting my research at the 'Born in Fire' conference, September 24-27, 2024, Santiago, Chile

3. I was an ***Infosys fellow,*** received the ***Infosys-TIFR Leading Edge Travel Grant*** to attend the RAVEYSO conference at ESO Garching, followed by a visit to the Konkoly Observatory, Budapest, Hungary.

4. I was awarded a *Certificate of Merit by the Indian Association of Physics Teachers* for securing the top 1% rank in the National Graduate Physics Examination, 2019.

5. I received *a Certificate of Merit and a Scholarship from the School Education Department, Madhya Pradesh, 2016.* Awarded to students achieving over 85% marks in the Madhya Pradesh State Board Intermediate Class Exams.

Research Interest

- Disk-mediated accretion dynamics. The morphology and dynamics of accretion from the star-disk junction to the stellar surface and its evolution with time. I have authored research on the accretion dynamics and their evolution on an accreting YSO.

- Understanding the triggering mechanism of the accretion-driven outbursts in YSOs (FUors, EXors). My work on an outbursting YSO is under review.

- Understanding high-mass star formation through multiband observations and photo-dissociated region (PDR) modeling. I am involved with the meticulous monitoring of star-forming regions at the FIR [CII] line with an indigenous 100cm telescope flown with a 100m balloon above the stratosphere. I have a co-authored research paper recently published.

Astronomical Proposals

Principal Investigator (P.I.) and Co-Investigator (Co-I) of accepted observing proposals

1. **P.I.** of multiple accepted proposals on the 3.6m Devasthal Optical Telescope and the 2m Himalayan Chandra Telescope. These proposals were aimed at long-term optical and NIR photometric and spectroscopic observations of outbursting YSOs.

2. **P.I.** of 1 accepted proposal in the Giant Meterwave Radio Telescope (GMRT). It was proposed to observe free-free emission from HII regions around outbursting YSOs. The data is being reduced by me.

3. **Co-I** of 1 accepted proposal on the Very Large Telescope. The proposal aimed at observing a particular outbursting YSO. I am the lead author of the data retrieved.

4. **Co-I** of 3 accepted proposals for the 10m Southern African Large Telescope. The proposals aimed at observing outbursting YSOs and Herbig AeBe sources spectroscopically. I am the lead author on one of the proposals; the other proposal is ongoing.

Computational Tools

- Developed software to generate [CII] (at 158 μm) line map from a single-pixel detector onboard a Balloon-Borne 100 cm telescope. Our Indigenous telescope flies over the stratosphere and observes the best coolants of the PDRs, [CII] line from the star-forming regions. The software handles various systematics and irregularities in the raw dataset and produces calibrated line and continuum maps at 158 μm.
- Experienced with X-shooter spectra reduction. I used the EsoReflex environment to install the X-shooter pipeline and reduced the data obtained through our proposal.
- I have reduced simultaneous optical to near-infrared (NIR) multi-order spectra from TANSPEC onboard 3.6m DOT and 2m HCT. I use IRAF and custom-built tools in Python to reduce and calibrate single and multiple-order spectra.
- Experienced in Optical and NIR photometry. I have developed Python tools to perform top-to-bottom Aperture and PSF photometry.
- I developed a tool to locate very precisely the various thermal regions of the accretion hotspot over the stellar surface. It uses the multiband optical lightcurves to probe thermal regions, and it handles the stellar activity introduced into the lightcurve wisely.
- I am experienced with the interpretation of high-resolution spectra through multi-Gauss modeling of the spectral lines and various other measures.

Publications

1. **Koshvendra Singh,** J. P. Ninan, Z. Guo, V. Ivanov, D. A. H. Buckley, D. K. Ojha, A. Monson, T. Chand, S. Sharma, R. K. Yadav, D. K. Sahu, P. Kumar, V. Elbakyan, S. Nayakshin, V. Fermiano, M. Fang, J. Borissova, W. P. Chen, F. J. Hambsch, R. Kurtev, C. Morris, J. Osses, V. Rodriguez, T. Sharma, B. Srikanth, T. Thanathibodee, W. H. Wang, Y. Zhou, "*Gaia24ccy: An outburst followed the footsteps of its predecessor*", ApJ, 2025 *under review.*

2. **Koshvendra Singh**, J. P. Ninan, M. M. Romanova, D. A. H. Buckley, D. K. Ojha, A. Ghosh, A. Monson, M. Schramm, S. Sharma, D. E. Reichart, J. Mikolajewska, J. C. Beamin, J. Borissova, V. D. Ivanov, V. V. Kouprianov, Franz-Josef Hambsch, A. Pearce, "*Accretion Funnel Reconfiguration during an Outburst in a Young Stellar Object: EX Lupi*", ApJ, Volume 968, Number 2 (2024).

3. **Koshvendra Singh**, D. K. Ojha, J. P. Ninan, S. Sharma, S. Ghosh, A. Ghosh, B. C. Bhatt, D. K. Sahu, "*Quiescence of an Outburst of a Low-Mass Young Stellar Object: LDN1415-IRS*", JOAA, Volume 44, Number 2, p. 58 (2023).

4. Carlos Contrares Pena, Jeong-Eun Lee, Gregory Herczeg, et al., **Koshvendra Singh** ..,"*The Outbursting YSOs Catalog (OYCAT)*"

5. Tarak Chand, Saurabh Sharma, **Koshvendra Singh,** Jeewan Pandey, et al. "*Long-term investigation of an open cluster Berkeley 65*", FSPAS, Volume 12 (2025).

6. T. Kusune, H. Tsuji, S. Oyabu, H. Kaneda, T. Suzuki, A. Yasuda, D. K. Ojha, S. K. Ghosh, **Koshvendra Singh**, J. P. Ninan, '*Magnetic fields in massive star-forming region NGC 6334' and their*

relationship with the properties of dust filaments probed by [CII] and PAH emissions', PASJ, Volume 77, 890-898 (2025).

7. A. Ghosh, S. Sharma, J. P. Ninan, D. K. Ojha, A. S. Gour, R. Pandey, T. Sinha, A. Verma, **Koshvendra Singh**, S. Ghosh, H. Kaur, "*Spectroscopy of 9 eruptive young variables using TANSPEC*", JOAA, Volume 44, Number 1, p. 50 (2023).

8. A. Ghosh, S. Sharma, J. P. Ninan, D. K. Ojha, A. Verma, T. C. Sahu, R. Pandey, **Koshvendra Singh,** "*Initial results of our spectro-photometric monitoring of XZ Tau*", Bulletin de la Société Royale des Sciences de Liège (Accepted), 2024.

9. S. B. Bhagat, M. B. Naik, S. S. Poojary, H. Shah, R. B. Jadhav, B. G. Bagade, S. L. D'Costa, B. K. Reddy, N. Nanjappa, T. Bangia, D. K. Ojha, S. Sharma, **Koshvendra Singh**, "*TIRCAM2 Camera Interface on the Side port of the 3.6 meter Devasthal Optical Telescope*", JOAA, Volume 44, Number 2, p. 64 (2023).

10. M. B. Naik, D. K. Ojha, S. Sharma, S. B. Bhagat, S. L. D'Costa, A. Ghosh, **Koshvendra Singh**, "*TIRCAM2 Fast Sub-array Readout Mode for Lunar Occultation studies*", JOAA, Volume 44, Number 1, p. 51 (2023).

Attended Conferences / Schools

1. May 19 - 24, 2025, Attended ''Role of accretion and ejection variability in the evolution of young stars and their disks'', Garching, Germany, and contributed with a talk on '*Parameterizing the accretion hotspot: Understanding the accretion morphology of low-mass stars*'.

2. May 26-30, 2025, visited "Konkoly Observatory, Budapest, Hungary", and delivered an institute seminar titled, '*Accretion Outbursts: A Problem and a Probe*'.

3. September 24 - September 24, 2024, Attended a conference on 'Born in Fire, Eruptive Stars and Planet Formation', Santiago, Chile, and contributed a talk on *'Hotspot migration during an Outburst in a YSO: EX Lupi*'.

4. September 2 - September 5, 2024, Attended the conference on 'Jets and Young Star: From Discovery to JWST and Beyond', Westport, Ireland, and presented a poster titled '*Discovery of hotspot migration during an outburst of a YSO, EX Lupi*'.

5. April 29 - May 2, 2024, Attended online conference on 'Science with the Hubble and James Webb Space Telescopes VII: Stars, Gas & Dust in the Universe', Porto, Portugal.

6. March 11- March 14, 2024, Attended online conference on 'ULLYSES: Continuing the Voyage of Discovery, STScI, Baltimore, USA. Presented poster on '*Discovery of accretion induced hotspot migration in a young star's magnetosphere: An outburst in EX Lupi*'.

7. March 6 - March 9, 2024, Attended Young Astronomers' Meet, Christ University, Bangalore. Delivered a contributed talk on '*Migration of accretion-induced hotspot over stellar surface during an outburst in EX Lupi*'.

8. January 31 - February 4, 2024, Attended '42nd Meeting of the Astronomical Society of India', hosted jointly by IISc, ISRO, and JNP, Bangalore. Delivered a contributed talk on '*Discovery of Accretion Hotspot Migration, An outburst in a YSO: EX Lupi*'.

9. January 8 - January 11, 2024, Attended the 'Star Formation Studies in India' conference at S. N. Bose National Institute of Basic Sciences, Kolkata. Presented a poster titled '*Accretion Funnel Reconfiguration during an Outburst in a Young Stellar Object: EX Lupi'*.

10. March 13 - March 24, 2023, Attended Radio Astronomy School at the National Center of Radio Astrophysics, Pune

11. January 16 - January 19, 2023, Attended conference on 'Magnetism & Accretion, A conference in memory of Darragh O'Donoghue', Cape Town, South Africa. Delivered a contributed talk on '*Did Accretion Funnel reconfigure during the EX Lupi's Accretion-Outburst?*'.

12. November 14 - November 15, 2022, Online attended the SALT Workshop, SAAO, Cape Town, South Africa.

13. May 4 - May 7, 2022, Attended conference 'Star Formation Studies in the Context of NIR Instruments on 3.6m DOT', ARIES, Nainital. Contributed talk titled '*Post-Outburst Phase of LDN1415-Neb*'.

14. February 3 - February 5, 2021. Attended the 'Sokendai Winter School', Japan (Online).

Responsibilities Held

- Conference Chair, '**Young Astronomers' Meet 2025**', March 18-21, 2025, TIFR, Mumbai, India.
- Organized weekly departmental Journal Club 'DAA-TIFR Astro Coffee Discussions' for one and a half years.

Science Outreach Activities

1. Delivered a public talk titled '*From Dust to Stars and Planets*', on the occasion of National Science Day, February 25, 2024, at TIFR.

2. Delivered an outreach talk titled '*Astronomy for you all*', to 9-10 standard students at Christ University, Bangalore, March 6, 2024.

3. Led 5 infrared lab presentations and demos for school kids, and students on various occasions, such as National Science Day, Frontier of Science, and Vigyan Vidushi at TIFR, Mumbai.

Mentored Students

1. I mentored Archis Mukhopadhyay and Gautam Das on their NIUS (National Initiative on Undergraduate Sciences) projects at TIFR. They developed a fantastic tool to model the spectra of the FU Orionis star-disk system. Archis did a summer project in Germany, and Gautam worked on a summer project with Lynne Hillenbrand at Caltech. They are final-year BS-MS students at IISER-Kolkata.

2. I mentored another Master's student, Nikhil. He worked on modeling the spots (hot and cold) over the stellar surface of the YSO using TESS lightcurves. He is currently a Research Associate at Ahmedabad University, India.

3. I am mentoring another NIUS student, Saee Joshi. She is working on TESS lightcurves to search for Quasi-Periodic Oscillations. She is currently pursuing MSc at Christ University, Bengaluru, India.

4. I also mentored Abhay Kumar Prusty and Suman Sourav Biswal for their master's projects at TIFR.