Himanshu Tyagi

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Mailing Address
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Tata Institute of Fundamental Research
Homi Bhabha Road, Mumbai 400-005, India

Research Interests

Protostellar Evolution, Protostellar Outflows, Astrochemistry, Protostellar and protoplanetary disks, Star and Planet Formation, Exoplanets, multi-wavelength observational astronomy, NIR/Optical Instrumentation

Education

Ph.D. Tata Institute of Fundamental Research, Mumbai, India (2019-Present)
Astronomy
Dissertation: "Characterizing Protostellar Evolution: A Systematic Multi-Wavelength Study of Nearby Protostars"
Committee: Prof. Manoj Puravankara (chair), Dr. Joe Philip Ninan, Prof. Shriganesh Prabhu

M.Sc. Tata Institute of Fundamental Research, Mumbai, India May 2021
Physics

B.Sc. Banaras Hindu University, Varanasi, India May 2019
Physics (hons.), Mathematics, and Geography

XIIth SASSVM, Ambehta Peer, Saharanpur, UP, India (U.P. board) May 2015

Xth SASSVM, Ambehta Peer, Saharanpur, UP, India (U.P. board) May 2013

Awards and Grants

NAOJ Travel Grant June 2024
Awarded by the National Astronomical Observatory of Japan (NAOJ) to attend the East Asian ALMA Science and Data Analysis workshop at Seoul National University

Infosys-TIFR Leading Edge Research Grant April 2023
Awarded by Infosys Foundation for cutting-edge research projects up to 200,000 INR.

Vigyan Chatra Samman 2013-14

Awarded by State government for getting highest marks in Mathematics in UP Board High School Examination

Research Groups

Team member of the JWST Cycle-3 proposal, "HEFE: High Angular Resolution observations of Stellar Emergence in Filamentary Environments" (PI – Tom Megeath)

Team member of the JWST GO Cycle-1 proposal "Illuminating the Dust Properties in the Diffused ISM with JWST" (PI – Sascha Zeegers)

Team member of the JWST GO Cycle-1 proposal "Investigating Protostellar Accretion (IPA)" (PI – Tom Megeath)

Optical and Software designing team for Multi-Object Infrared Spectrograph (MOIS)

Observation Experience

- NIR and Optical Spectroscopy with NASA IRTF, Mauna kea
- Radio Interferometry Observation with GMRT, India
- NIR and Optical Spectroscopy with 3.6m DOT, India
- NIR and Optical Spectroscopy with 2-m HCT, India

Successful Proposals

- Co-I of ALMA Cycle 11 Proposals:
  - The Nested doll protostellar jet structure: Capturing the inner warm CO (6-5) molecular backbone of JWST jets (PI – Mayank Narang)
  - Mining for atomic carbon in protostellar jets (PI – Łukasz Tychoniec)
  - Outflow impact on dense gas in a nearby filament (PI – Héctor G. Arce)

- Co-I of JWST Cycle 3 Proposals:
  - HEFE: High Angular Resolution Observations of Stellar Emergence in Filamentary Environments (PI – Tom Megeath)
  - Constraining the volatile budget in the birthplace of TRAPPIST-1-like systems (PI – Pooneh Nazari)
  - Following the water throughout star formation via its deuteration ratio in ice (PI – Katerina Slavicinska)

- Co-I of HST Cycle 31 proposal
  - An HST + JWST Investigation of Two Protostellar Outflows in Orion: Tracing Jets From 100 au to 100,000 au (PI – Tom Megeath)

- PI of uGMRT survey of thermal jets in nearby protostars (uGMRT).
- Co-I of proposals on Giant Metrewave Radio Telescope (uGMRT).
- PI and Co-I of proposals on 3.6 m Devasthal Optical Telescope (DOT).

- PI and Co-I of proposals on 2-m Himalayan Chandra Telescope (HCT).
- PI and Co-I of proposals on NASA Infrared Telescope Facility (NASA IRTF)

Teaching Experience

Tata Institute of Fundamental Research, Mumbai Feb 2022 to Aug 2022
Teaching Assistant for Astronomy and Astrophysics II course by Prof. Sudip Bhattacharyya and Dr. Shriharsh Tendulkar for TIFR Graduate students (2022).

Tata Institute of Fundamental Research, Mumbai August 2024 to present
Teaching Assistant for Astronomy and Astrophysics I course by Prof. Manoj Puravankara for TIFR Graduate students.

Services and Public Outreach

- Co-chair of LOC of Young Astronomers' Meet 2025 at TIFR
- Gave TIFR infrared lab demonstration on National Science Day at TIFR (2024)
- Helped organize TIFR Open Day (2023)
- Organized telescopes for sunspot observation for National Science Day at TIFR (2023)
- Helped organize National Science Day at TIFR (2019)
- Helped organize TIFR Open Day (2019)
- Set up telescopes during various astronomical events in TIFR

Conferences, Workshops, School & Visits

Attended Workshop, "Total power and mosaic", East Asian ALMA Data Analysis Workshop 2024, 25-26 July 2024, Seoul National University: Siheung campus, Seoul, South Korea.

Poster Presentation, "IPA: JWST-ALMA Reveal Nested Structure of Protostellar Winds," East Asian ALMA Science Workshop 2024, 22-24 July 2024, Seoul National University: Siheung campus, Seoul, South Korea.

Delivered Workshop, "Using JWST IFU data cubes,**"** 05 February 2024, CHRIST University, Bengaluru, India.

Talk, "IPA on the Rocks: JWST unveiling building blocks of Planets,"
42nd meeting of the Astronomical Society of India (ASI), 31 January to 04 February 2024, Indian Institute of Science (IISc), Indian Space Research Organization (ISRO) and Jawaharlal Nehru Planetarium (JNP), Bengaluru, India.

Poster Presentation, "IPA on the Rocks: JWST unveiling building blocks of Planets," Star Formation Studies in India, 08-11 January 2024, SNBNCBS, Kolkata, India.

Poster Presentation, "IPA on the Rocks: JWST unveiling building blocks of Planets," Strange New Worlds: The Exploration of ExoPlanets, 17-19 August 2023, IISER Pune, India.

Poster Presentation, "A uGMRT Low Radio-frequency Perspective of Protostellar Jets Observed with JWST," Protostars and Planets VII, 10-15 April 2023, Kyoto, Japan.

Conference, "First Science Results from JWST," 12-15 December 2022, STScI, Virtual.

Talk, "Evolution of Silicate Dust during Star and Planet Formation," Young Astronomers' Meet 2022, 9-13 November, ARIES, Nainital, India.

Poster Presentation, "Exploring Optical Counterparts of Protostars and their Accretion rates with Gaia DR3", Gaia Symposium: DR3 and Beyond, 11-15 July 2022, IIA Bengaluru, online.

Attended Workshop, 18th Synthesis Imaging Workshop, 18-25 May 2022, NRAO, online.

Attended Workshops, STScI on JWST data reduction and analysis (JWebbinars), online.

Attended Workshop in 3rd Meeting on Star Formation, Star Formation Studies in the Context of NIR Instruments on 3.6m DOT, 04-07 May 2022, ARIES, Nainital & TIFR, Mumbai, Nainital

Poster Presentation, "Breaking the Shock Degeneracy: The Origin of Water Emission in Protostars," 40th meeting of the Astronomical Society of India, 25-29 March 2022, IIT Roorkee.

Attended Workshop, Rock, Dust, and Ice: Interpreting planetary data, 23-26 March 2021, SOFIA workshop, online.

Poster Presentation, "Does Silicate Crystallization occur in the Protostars," 39th meeting of the Astronomical Society of India, 18-23 February 2021, online.

Conference, Exostar Redux – Online Reunion Conference, Aug 2020, KITP, USA.

Mentorship

- Rupam Kundu (IISER Berhampur, 2023) – M.Sc. Thesis project on the Characterization of the silicate dust in protostellar envelopes.

Languages

Hindi: Native Language
English: Intermediate Listener and Speaker, Advanced Reading, and Writing
Japanese: Beginner

Computer Skills

Programming: Python, IRAF CL, LaTeX

Applications: CARTA, Common Astronomy Software Applications (CASA), Herschel Interactive Processing Environment (HIPE), Mathematica, LabVIEW, MS Office (Word, Excel, and PowerPoint)

Version control: Git

Platforms: Linux, Microsoft Windows, and macOS

Publications

JWST-IPA: Chemical Inventory and Spatial Mapping of Ices in the Protostar HOPS370 -- Evidence for an Opacity Hole and Thermal Processing of Ices
arXiv e-prints
2024 | Preprint
DOI: 10.48550/arXiv.2410.06697
Contributors: **Himanshu Tyagi**; Manoj P.; Mayank Narang; S T. Megeath; Will Robson M. Rocha; Nashanty Brunken; Adam E. Rubinstein; Robert A. Gutermuth; Neal J. Evans; Ewine van Dishoeck et al.

IPA: Class 0 Protostars Viewed in CO Emission Using JWST
The Astrophysical Journal
2024-10-01 | Journal article
DOI: 10.3847/1538-4357/ad6b92
Contributors: Adam E. Rubinstein; Neal J. Evans, II; **Himanshu Tyagi**; Mayank Narang; Pooneh Nazari; Robert Gutermuth; Samuel Federman; P. Manoj; Joel D. Green; Dan M. Watson et al.

JWST detections of amorphous and crystalline HDO ice toward massive protostars
Astronomy & Astrophysics
2024-08 | Journal article
DOI: 10.1051/0004-6361/202449785
Contributors: Katerina Slavicinska; Ewine F. van Dishoeck; Łukasz Tychoniec; Pooneh Nazari; Adam E. Rubinstein; Robert Gutermuth; **Himanshu Tyagi**; Yuan Chen; Nashanty G. C. Brunken; Will R. M. Rocha et al.

Host-star Properties of Hot, Warm, and Cold Jupiters in the Solar Neighborhood from Gaia Data Release 3: Clues to Formation Pathways
The Astronomical Journal
2024-07-01 | Journal article
DOI: 10.3847/1538-3881/ad429f
Contributors: Bihan Banerjee; Mayank Narang; P. Manoj; Thomas Henning; **Himanshu Tyagi**; Arun Surya; Prasanta K. Nayak; Mihir Tripathi

Hunting for complex cyanides in protostellar ices with the JWST. A tentative detection of CH3CN and C2H5CN
Astronomy and Astrophysics
2024-06 | Journal article
DOI: 10.1051/0004-6361/202348695
BIBCODE: 2024A&A...686A..71N
ARXIV: 2401.07901
Contributors: Nazari, P.; Rocha, W. R. M.; Rubinstein, A. E.; Slavicinska, K.; Rachid, M. G.; van Dishoeck, E. F.; Megeath, S. T.; Gutermuth, R.; **Tyagi, H.**; Brunken, N. et al.

JWST observations of 13CO2 ice
Astronomy & Astrophysics
2024-05 | Journal article
DOI: 10.1051/0004-6361/202348718
Contributors: Nashanty G. C. Brunken; Will R. M. Rocha; Ewine F. van Dishoeck; Robert Gutermuth; **Himanshu Tyagi**; Katerina Slavicinska; Pooneh Nazari; S. Thomas Megeath; Neal J. Evans II; Mayank Narang et al.

Investigating Protostellar Accretion-driven Outflows across the Mass Spectrum: JWST NIRSpec Integral Field Unit 3–5 μm Spectral Mapping of Five Young Protostars
The Astrophysical Journal
2024-05-01 | Journal article
DOI: 10.3847/1538-4357/ad2fa0
Contributors: Samuel A. Federman; S. Thomas Megeath; Adam E. Rubinstein; Robert Gutermuth; Mayank Narang; **Himanshu Tyagi**; P. Manoj; Guillem Anglada; Prabhani Atnagulov; Henrik Beuther et al.

JWST/MIRI Detection of Suprathermal OH Rotational Emissions: Probing the Dissociation of the Water by Lyα Photons near the Protostar HOPS 370
The Astrophysical Journal Letters
2024-05-01 | Journal article
DOI: 10.3847/2041-8213/ad3d48
Contributors: David A. Neufeld; P. Manoj; **Himanshu Tyagi**; Mayank Narang; Dan M. Watson; S. Thomas Megeath; Ewine F. Van Dishoeck; Robert A. Gutermuth; Thomas Stanke; Yao-Lun Yang et al.

A uGMRT search for radio emission from planets around evolved stars
Monthly Notices of the Royal Astronomical Society
2024-04 | Journal article
DOI: 10.1093/mnras/stae536
BIBCODE: 2024MNRAS.529.1161N
ARXIV: 2402.11182
Contributors: Narang, Mayank; Manoj, P.; Chandra, C. H. Ishwara; Banerjee, Bihan; **Tyagi, Himanshu**; Tamura, Motohide; Henning, Thomas; Mathew, Blesson; Lazio, Joseph; Surya, Arun et al.

Discovery of a Collimated Jet from the Low-luminosity Protostar IRAS 16253−2429 in a Quiescent Accretion Phase with the JWST
The Astrophysical Journal Letters
2024-02-01 | Journal article
DOI: 10.3847/2041-8213/ad1de3
Contributors: Mayank Narang; P. Manoj; **Himanshu Tyagi**; Dan M. Watson; S. Thomas Megeath; Samuel Federman; Adam E. Rubinstein; Robert Gutermuth; Alessio Caratti o Garatti; Henrik Beuther et al.

Optical spectroscopy of Gaia detected protostars with DOT: Can we probe protostellar photospheres?
Journal of Astrophysics and Astronomy
2023-12 | Journal article
DOI: 10.1007/s12036-023-09982-4
BIBCODE: 2023JApA...44...92N
ARXIV: 2308.12689
Contributors: Narang, Mayank; Manoj, P.; **Tyagi, Himanshu**; Nayak, Prasanta K.; Sharma, Saurabh; Surya, Arun; Banerjee, Bihan; Mathew, Blesson; Ghosh, Arpan; Verma, Aayushi

MOIS: a configurable slit multi-object infrared spectrograph
Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series
2023-10 | Conference paper
DOI: 10.1117/12.2677722
BIBCODE: 2023SPIE12677E..0AS
Contributors: A. Surya, M. Puravankara, B. Mookerjea, S. Poojary, S. L. A. D. Costa, M. Narang, P. P. Madhwani, A. P. K. Kutty, S. B. Bhagat, H. Shah, B. Banerjee, S. Gharat, R. Jadhav, V. N. Kurhade, J. V. Parmar, **H. Tyagi**

Identifying the population of T-Tauri stars in Taurus: UV–optical synergy
Journal of Astrophysics and Astronomy
2023-09-23 | Journal article
DOI: 10.1007/s12036-023-09972-6
Part of ISSN: 0973-7758
Contributors: Prasanta Kumar Nayak; Mayank Narang; Manoj Puravankara; **Himanshu Tyagi**; Bihan Banerjee; Saurabh Sharma; Rakesh Pandey; Arun Surya; Blesson Mathew; R. Arun et al.

uGMRT observations of the hot-Saturn WASP-69b: Radio-Loud Exoplanet-Exomoon Survey II (RLEES II)
Monthly Notices of the Royal Astronomical Society
2023-06 | Journal article
DOI: 10.1093/mnras/stad1027
BIBCODE: 2023MNRAS.522.1662N
ARXIV: 2303.17269

Contributors: Narang, Mayank; Oza, Apurva V.; Hakim, Kaustubh; Manoj, P.; **Tyagi, Himanshu**; Banerjee, Bihan; Surya, Arun; Nayak, Prasanta K.; Banyal, Ravinder K.; Thorngren, Daniel P.

Emission line star catalogues post-Gaia DR3
Astronomy & Astrophysics
2022-12 | Journal article
DOI: 10.1051/0004-6361/202244353
Part of ISSN: 0004-6361
Part of ISSN: 1432-0746
Contributors: B. Shridharan; B. Mathew; S. Bhattacharyya; T. Robin; R. Arun; S. S. Kartha; P. Manoj; S. Nidhi; G. Maheshwar; K. T. Paul; Narang, M.; **Tyagi, H.**