

## Curriculum Vitae

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DR. MILAN SIL

### CONTACT INFORMATION

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### CURRENT AFFILIATION

Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), Université Grenoble Alpes, 38000 Grenoble, France  
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Département "Physique Moléculaire", Institut de physique de Rennes (IPR), Université de Rennes, 129/1 Bât 11b, Campus de Beaulieu, 263 avenue du Général Leclerc 35042 Rennes, France

### WEBSITES

ORCID — Google Scholar — Research Gate — LinkedIn — Twitter

### RESEARCH INTERESTS

- Molecular excitation and radiative transfer for astrochemistry applications
- Quantum chemical study
- Synthesis of Complex Organic Molecules (COMs) in star-forming regions
- Astrochemical modeling in radiation-dominated regions

My research background is in theoretical and computational astrochemistry. My research focuses on modeling the molecular complexity in different astrophysical environments (especially high-radiation environments such as supernova remnants filamentary region, planetary nebula, PDR, HII region, diffuse ISM) using CLOUDY spectral synthesis code. I study molecular excitation and radiative transfer modeling for astrochemistry applications such as analyzing observational data and providing constraints on some physical parameters such as density, column density, kinetic and excitation temperature using RADEX radiative transfer code. In addition, I do complementary various *ab initio* quantum chemical computations like binding energies of atomic/radical/molecular species on icy dust surfaces, spectroscopic constants, infrared features, activation barrier for a reaction through transition state calculations, etc. (using Gaussian 09/16 computational chemistry program) necessary for modeling and spectroscopy purposes.

### RESEARCH EMPLOYMENT

- **Postdoctoral Researcher** June 2023 to Present  
Institut de Planétologie et d'Astrophysique de Grenoble (IPAG)  
Université Grenoble Alpes (UGA)  
F-38000 Grenoble, France  
===== & =====  
Institut de physique de Rennes (IPR)  
Université de Rennes  
129/1 Bât 11b, Campus de Beaulieu, 263 avenue du Général Leclerc  
35042 Rennes, France
- **Post Doctoral Research Associate - I** May 2022 to May 2023  
Department of Astrophysics and High Energy Physics

Satyendra Nath Bose National Centre for Basic Sciences  
Block-JD, Sector-III, Salt Lake, Kolkata-700 106, India

- **Ph.D. Research Fellow** 2016-2021  
University of Calcutta, Kolkata, India  
Advisor: Dr. Ankan Das

EDUCATIONAL /  
ACADEMIC  
QUALIFICATION

**Ph.D. in Physics, June 23, 2022**

**University of Calcutta**, Kolkata, India

- Thesis title: **Physics and Chemistry of the Star Forming Region and Protoplanetary Disk**
- Advisor: Dr. Ankan Das

**M.Sc. in Physics, August 2015**

**University of Calcutta**, Ramakrishna Mission Residential College, Narendrapur, Kolkata, India

**B.Sc., Graduated with first-class honours in Physics, May 2013**

**University of Calcutta**, Serampore College, Serampore, India

REFEREED  
JOURNAL  
PUBLICATIONS

1. Adsorption energies of H and H<sub>2</sub>: A Quantum Chemical Study, **Milan Sil**, Prasanta Gorai, Ankan Das, Dipen Sahu, & Sandip K. Chakrabarti, 2017, The European Physical Journal D, 71, 45.
2. Chemical Modeling for Predicting the Abundances of Certain Aldimines and Amines in Hot Cores, **Milan Sil**, Prasanta Gorai, Ankan Das, Bratati Bhat, & Sandip K. Chakrabarti, 2018, The Astrophysical Journal, 853, 139.
3. An Approach to Estimate the Binding Energy of Interstellar Species, Ankan Das, **Milan Sil**, Prasanta Gorai, Sandip K. Chakrabarti, & J. C. Loison, 2018, The Astrophysical Journal Supplement Series, 237, 9.
4. Identification of Pre-biotic Molecules Containing Peptide-like Bond in a Hot Molecular Core, G10.47+0.03, Prasanta Gorai, Bratati Bhat, **Milan Sil**, Suman K. Mondal, Rana Ghosh, Sandip K. Chakrabarti, & Ankan Das, 2020, The Astrophysical Journal, 895, 86.
5. Systematic Study on the Absorption Features of Interstellar Ices in the Presence of Impurities, Prasanta Gorai, **Milan Sil**, Ankan Das, Bhalamurugan Sivaraman, Sandip K. Chakrabarti, Sergio Ioppolo, Cristina Puzzarini, Zuzana Kanuchova, Anita Dawes, Marco Mendolicchio, Giordano Mancini, Vincenzo Barone, Naoki Nakatani, Takashi Shimonishi, & Nigel Mason, 2020, ACS Earth and Space Chemistry, 4, 920.
6. Exploring the Possibility of Identifying Hydride and Hydroxyl Cations of Noble Gas Species in the Crab Nebula Filament, Ankan Das, **Milan Sil**, Bratati Bhat, Prasanta Gorai, Sandip K. Chakrabarti, & Paola Caselli, 2020, The Astrophysical Journal, 902, 131.
7. Effect of binding energies on the encounter desorption, Ankan Das, **Milan Sil**, Rana Ghosh, Prasanta Gorai, Soutan Adak, Subhankar Samanta, & Sandip K. Chakrabarti, 2021, Frontiers in Astronomy and Space Sciences, 8, 78.
8. Chemical complexity of phosphorous bearing species in various regions of the interstellar medium, **Milan Sil**, Satyam Srivastav, Bratati Bhat, Suman Kumar Mondal, Prasanta Gorai, Rana Ghosh, Takashi Shimonishi, Sandip K. Chakrabarti, Bhalamurugan Sivaraman, Amit Pathak, Naoki Nakatani, Kenji Furuya, Ankan Das, 2021, The Astronomical Journal, 162, 119.

9. Is there any linkage between interstellar aldehyde and alcohol? Suman K. Mondal, Prasanta Gorai, **Milan Sil**, Rana Ghosh, Emmanuel E. Etim, Sandip K. Chakrabarti, Takashi Shimonishi, Naoki Nakatani, Kenji Furuya, Jonathan C. Tan, and Ankan Das, 2021, *The Astrophysical Journal*, 922, 194.
10. Phenol in high-mass star-forming regions, Rana Ghosh, **Milan Sil**, Suman K. Mondal, Prasanta Gorai, Dipen Sahu, Rahul Kumar Kushwah, Bhalamurugan Sivaraman, and Ankan Das, 2022, *Research in Astronomy and Astrophysics*, 22, 065021.
11. Astrochemical model to study the abundances of branched carbon-chain molecules in a hot molecular core with realistic binding energies, Satyam Srivastav, **Milan Sil**, Prasanta Gorai, Amit Pathak, Bhalamurugan Sivaraman, Ankan Das, 2022, *Monthly Notices of the Royal Astronomical Society*, 515, 3524.

PUBLICATION IN  
PROCEEDINGS

1. Binding Energy and Isomerism: Two Important Aspects of Astrochemistry, **Milan Sil**, 2018, In: Mukhopadhyay B., Sasmal S. (eds) *Exploring the Universe: From Near Space to Extra-Galactic. Astrophysics and Space Science Proceedings*, vol 53. Springer, Cham.

CONTRIBUTED  
ORAL  
PRESENTATIONS

- Astrochemistry in the THz domain, October 2017, Chennai, India  
Title: "Systematic study on the presence of impurities on interstellar ices"
- 42nd COSPAR Scientific Assembly, July 2018, USA  
Title: "Binding energy a key to defining interstellar volatile species"  
Title: "A Systematic Study of Pre-biotic Aldimines and Amines in Hot Cores"  
Title: "A Theoretical Prediction of Interstellar Bio-Molecule abundances"
- Exploring the Universe: Near Earth Space Science to Extra-Galactic Astronomy — S. N. Bose National Centre for Basic Sciences, Kolkata, India — 14 – 17 November 2018  
Title: "A New Set of Binding Energies for Astrochemical Modeling"
- 43rd COSPAR Scientific Assembly (COSPAR-2021-Hybrid), 28 January - 4 February 2021, Sydney Australia.  
Title: "Fate of identifying noble gas related species in the Crab nebula environment"
- Atomic Molecular and Optical Physics Division area seminar (online) — Physical Research Laboratory — Astrochemistry Early Career Researchers Webinar — 15 July 2021  
Title: "Chemical composition in various evolutionary phases of the star-forming regions"
- Astrochemistry Discussions — Early-Career Day! — Wednesday 8 December 2021  
Title: "Binding Energy: a Fundamental Parameter to Formulate Interstellar Chemistry"
- Evolved Stars and their Circumstellar Environments — 14 - 17 December 2021  
Title: "Exploring Noble Gas Species in the Radiation-Dominated Region"
- 44th COSPAR Scientific Assembly, 16 - 24 July 2022, Athens, Greece.  
Title: "Binding energy: a fundamental parameter to model interstellar chemistry"

POSTER  
PRESENTATIONS

- International Conference on Infrared Astronomy and Astrophysical Dust, October 2019, IUCAA Pune, India  
Title: "Complex Organic Molecules in the Star Forming Region"

- 43rd COSPAR Scientific Assembly (COSPAR-2021-Hybrid), 28 January - 4 February 2021, Sydney Australia.  
Title: "Estimating realistic values of binding energy of species for astrochemical modeling"

WORKSHOP  
ATTENDED

- Meudon PDR code user training days, Paris Observatory, November 13-14, 2023, Meudon site of Paris Observatory, France.

TECHNICAL SKILLS

- Gaussian 09/16 suite of programs for computing chemical properties of species of astrochemical interest.
- Cloudy spectral synthesis code.
- RADEX radiative transfer code.
- Gas-grain chemical modeling.
- Fortran, Python, Shell, LATEX, Xmgrace, Gnuplot, Origin.
- Linux OS, Windows OS.

AWARDS /  
FELLOWSHIPS /  
PROFESSIONAL  
MEMBERSHIPS

Travel Awards:

- DST-SERB International Travel Support (ITS) for participating in the 42nd COSPAR Scientific Assembly, Pasadena, California, United States 14 - 22 July 2018
- Partial travel support from the Committee on Space Research for participating in the 42nd COSPAR Scientific Assembly, Pasadena, California, United States 14 - 22 July 2018
- Partial travel support from the Committee on Space Research for participating in the 44th COSPAR Scientific Assembly, Athens, Greece 16 - 24 July 2022

Student Awards / Fellowships:

- DST-INSPIRE Scholarship during B.Sc. and M.Sc. 2011-2015
- Holding rank in CSIR National Eligibility Test (NET) for Lectureship (LS) June 2015
- Holding all India rank in GATE (Physics) 2015 and 2016
- DST-INSPIRE Fellowship during Ph.D. 2016-2021

Professional Memberships:

- Member of the International Astronomical Union (IAU)
- Honorary Associate of Institute of Astronomy Space and Earth Science (IASSES), Kolkata, India