

## Dr. Liton Majumdar

---

### Contact Information

[From June 2019]

Assistant Professor  
National Institute of Science Education and Research  
(NISER)  
School of Earth and Planetary Sciences  
P.O: Bhimpur - Padanpur  
Via - Jatni, Khurda, Odisha, 752050, India  
<https://www.niser.ac.in/users/liton>

✉ [liton@niser.ac.in](mailto:liton@niser.ac.in)  
✉ [liton.icsp@gmail.com](mailto:liton.icsp@gmail.com)

&

[From June 2019]

Visiting Researcher  
NASA Jet Propulsion Laboratory  
California Institute of Technology  
4800 Oak Grove Drive, MS 169-506  
Pasadena, CA 91109, USA  
<https://science.jpl.nasa.gov/people/LMajumdar/>

✉ [liton.majumdar@jpl.nasa.gov](mailto:liton.majumdar@jpl.nasa.gov)

### Research Interests

- Observing signatures of planet formation at high spatial resolution with Atacama Large Millimeter/submillimeter Array (ALMA) and James Webb Space Telescope (JWST) in future
- Probing the connection between disks and (exo)planetary atmospheres
- ALMA observations to study physics, chemistry and dust structure in gas-rich protoplanetary disks
- Modelling chemical complexity and the origin of complex organic molecules in star-forming regions and planet-forming disks and the link with prebiotic chemistry in planetary systems
- Linking Astrophysics with Solar System Science and Cosmochemistry
- Future development and scientific capabilities of [Square Kilometre Array \(SKA\)](#), [Thirty Meter Telescope \(TMT\)](#), [Origin Space Telescope \(OST\)](#), [SPICA](#), and [Habitable Exoplanet Observatory \(HabEx\)](#) to revolutionize our understanding of planetary system formation

### Research Employment

**Assistant Professor** 24 June 2019 to present  
School of Earth and Planetary Sciences  
National Institute of Science Education and Research (NISER)

**Visiting Researcher** 24 June 2019 to present  
Interstellar and Heliospheric Physics group (3263)  
NASA Jet Propulsion Laboratory, USA  
California Institute of Technology

**NASA Post Doctoral Program Fellow** 10 July 2017 to 23 June 2019  
Interstellar and Heliospheric Physics group (3263)  
NASA Jet Propulsion Laboratory, USA  
California Institute of Technology

**CNRS Post Doctoral Researcher** Dec 2014 to June 2017  
Laboratoire d'astrophysique de Bordeaux  
University of Bordeaux, France

## Education

**Ph.D. in Physics, Nov 2014, University of Calcutta, Kolkata, India**

- Thesis Title: *Hydrodynamics and evolving composition of the collapsing interstellar cloud.*

**Post M.Sc. in Astrophysics, 2010, Grade A, S. N. Bose National Centre for Basic Sciences, Kolkata, India.**

- Project Title: *Formulation of Three Dimensional Total Variation Diminishing Scheme to solve Hyperbolic system of equations.*

**M.Sc. in Physics, 2009, 1st Class, University of Calcutta, Kolkata, India**

- Project Title: *Measurement of Absorption coefficient of a metal using X-ray detector.*

**B.Sc. (Honours) in Physics, 2007, 1st Class, University of North Bengal, West Bengal, India**

- Minors: *Mathematics and Chemistry*

## Refereed Journal Publications

1. V. Wakelam, E. Chapillon, A. Dutrey, S. Guilloteau, W. Iqbal, A. Coutens, **L. Majumdar**, *Protoplanetary disks: Sensitivity of the chemical composition to various model parameters*, 2019, **Monthly Notices of the Royal Astronomical Society**, 484, 1573 [[URL](#)].
2. Y. Seo, **L. Majumdar**, P. F. Goldsmith, Y. L. Shirley, K. Willacy, D. Ward-Thompson, R. Friesen et al., *An Ammonia Spectral Map of the L1495-B218 Filaments in the Taurus Molecular Cloud: II CCS & HC<sub>7</sub>N Chemistry and Three Modes of Star Formation in the Filaments*, 2019, **The Astrophysical Journal**, 871, 134 [[URL](#)].
3. **L. Majumdar**, P. Gratier, V. Wakelam, E. Caux, K. Willacy, M. E. Ressler, *Detection of HOCO<sup>+</sup> in the protostar IRAS 16293-2422*, 2018, **Monthly Notices of the Royal Astronomical Society**, 477, 525 [[URL](#)].
4. **L. Majumdar**, J. C. Loison, M. Ruaud, P. Gratier, V. Wakelam, A. Coutens, *Methyl isocyanate CH<sub>3</sub>NCO: An important missing organic in current astrochemical networks*, 2018, **Monthly Notices of the Royal Astronomical Society Letters**, 473, L59 [[URL](#)].
5. I. Andron, P. Gratier, **L. Majumdar**, T. Vidal, A. Coutens, J. C. Loison, V. Wakelam, *Methyl cyanide (CH<sub>3</sub>CN) and propyne (CH<sub>3</sub>CCH) in the low-mass protostar IRAS 16293-2422*, 2018, **Monthly Notices of the Royal Astronomical Society**, 481, 5651 [[URL](#)].
6. K. Taniguchi, M. Saito, **L. Majumdar**, T. Shimoikura, K. Dobashi, H. Ozeki, F. Nakamura, T. Hirota, T. Minamidani, Y. Miyamoto, H. Kaneko, *Chemical Diversity in Three Massive Young Stellar Objects Associated with 6.7 GHz CH<sub>3</sub>OH Masers*, 2018, **The Astrophysical Journal**, 866, 150 [[URL](#)].
7. N. T. Phuong, E. Chapillon, **L. Majumdar**, S. Guilloteau, V. Pietu, V. Wakelam, P. N. Diep, T. Beck, J. Barry, *The first detection of H<sub>2</sub>S in protoplanetary disk: The dense GG Tau A ring*, 2018, **Astronomy & Astrophysics Letter**, 616, L5 [[URL](#)].
8. T. Suzuki, **L. Majumdar**, M. Ohishi, M. Saito, T. Hirota, V. Wakelam, *An expanded gas-grain model for interstellar glycine*, 2018, **The Astrophysical Journal**, 863, 51 [[URL](#)].

9. T. Suzuki, M. Ohishi, M. Saito, T. Hirota, **L. Majumdar**, V. Wakelam, *The difference in abundance between N-bearing and O-bearing species in high-mass star forming regions*, 2018, **The Astrophysical Journal Supplementary Series**, 237, 42 [\[URL\]](#).
10. **L. Majumdar**, P. Gratier, M. Ruaud, V. Wakelam, C. Vastel, O. Sipilä, F. Hersant, A. Dutrey, S. Guolloteau, *Chemistry of TMC-1 with multiply deuterated species and spin chemistry of  $H_2$ ,  $H_2^+$ ,  $H_3^+$  and their isotopologues*, 2017, **Monthly Notices of the Royal Astronomical Society**, 466, 4470 [\[URL\]](#).
11. **L. Majumdar**, P. Gratier, I. Andron, V. Wakelam, E. Caux, *A study of singly deuterated cyclopropenylidene  $c\text{-C}_3\text{HD}$  in protostar IRAS 16293-2422*, 2017, **Monthly Notices of the Royal Astronomical Society**, 467, 3525 [\[URL\]](#).
12. P. Gorai, A. Das, **L. Majumdar**, B. Sivaraman, S. K. Chakrabarti, E. Herbst, *The Possibility of Forming Propargyl Alcohol in the Interstellar Medium*, 2017, **Molecular Astrophysics**, 6, 36 [\[URL\]](#).
13. **L. Majumdar**, P. Gratier, T. Vidal, V. Wakelam, J. C. Loison, K. M. Hickson, E. Caux, *Detection of  $CH_3SH$  in protostar IRAS 16293-2422*, 2016, **Monthly Notices of the Royal Astronomical Society**, 458, 1859 [\[URL\]](#).
14. P. Gratier, **L. Majumdar**, M. Ohishi, E. Roueff, J. C. Loison, K. M. Hickson, V. Wakelam, *A new reference chemical composition for TMC-1*, 2016, **The Astrophysical Journal Supplementary Series**, 225, 25 [\[URL\]](#).
15. T. Suzuki, M. Ohishi, T. Hirota, M. Saito, **L. Majumdar**, V. Wakelam, *Survey observation of a possible Glycine Precursor Methanimine  $CH_2NH$* , 2016, **The Astrophysical Journal**, 825, 79 [\[URL\]](#).
16. V. Wakelam, M. Ruaud, F. Hersant, A. Dutrey, D. Semenov, **L. Majumdar**, S. Guolloteau, *Importance of the  $H_2$  abundance in protoplanetary disk ices for the molecular layer chemical composition*, 2016, **Astronomy & Astrophysics**, 594, A35 [\[URL\]](#).
17. A. Das, D. Sahu, **L. Majumdar**, S. K. Chakrabarti, *Deuterium enrichment of the interstellar grain mantle*, 2015, **Monthly Notices of the Royal Astronomical Society**, 455, 540 [\[URL\]](#).
18. **L. Majumdar**, P. Gorai, A. Das, S. K. Chakrabarti, *Potential formation of three pyrimidine bases in interstellar regions*, 2015, **Astrophysics and Space Science**, 360, 64 [\[URL\]](#).
19. A. Das, **L. Majumdar**, D. Sahu, P. Gorai, B. Sivaraman, S. K. Chakrabarti, *Methyl Acetate and its singly deuterated isotopomers in the interstellar medium*, 2015, **The Astrophysical Journal**, 808, 21 [\[URL\]](#).
20. S. K. Chakrabarti, **L. Majumdar**, A. Das, S. Chakrabarti, *Search for interstellar Adenine*, 2015, **Astrophysics and Space Science**, 357, 90 [\[URL\]](#).
21. D. Sahu, A. Das, **L. Majumdar**, S. K. Chakrabarti, *Monte Carlo simulation for the formation of molecular hydrogen and its deuterated forms*, 2015, **New Astronomy**, 38, 23 [\[URL\]](#).
22. B. Sivaraman, N Radhika, A. Das, G. Goopakumar, **L. Majumdar**, S. K. Chakrabarti, K. P. Subramanian, M Hada, *Infrared Spectra and Chemical Abundance of Methyl Propionate in Icy Astrochemical Conditions*, 2015, **Monthly Notices of the Royal Astronomical Society**, 448, 1372 [\[URL\]](#).

23. A. Das, **L. Majumdar**, S. K. Chakrabarti, D. Sahu, *Deuterium enrichment of the interstellar medium*, 2015, **New Astronomy**, 35, 53 [\[URL\]](#).
24. **L. Majumdar**, A. Das, S. K. Chakrabarti, *Formation of different isotopomers of Chloronium in the interstellar medium*, 2014, **The Astrophysical Journal**, 782, 73 [\[URL\]](#).
25. **L. Majumdar**, A. Das, S. K. Chakrabarti, *Spectroscopic characteristics of the cyanomethyl anion and its deuterated derivatives*, 2014, **Astronomy & Astrophysics**, 562, 56 [\[URL\]](#).
26. A. Das, **L. Majumdar**, S. K. Chakrabarti, R. Saha, S. Chakrabarti, *Formation of cyanoformaldehyde in interstellar space*, 2013, **Monthly Notices of the Royal Astronomical Society**, 433, 3152 [\[URL\]](#).
27. A. Das, **L. Majumdar**, S. K. Chakrabarti, S. Chakrabarti, *Chemical evolution during the process of proto-star formation by considering a two dimensional hydrodynamic model*, 2013, **New Astronomy**, 23, 118 [\[URL\]](#).
28. **L. Majumdar**, A. Das, S. K. Chakrabarti, S. Chakrabarti, *Study the chemical evolution and spectral signatures of some interstellar precursor molecules of adenine, glycine and alanine*, 2013, **New Astronomy**, 20, 15 [\[URL\]](#).
29. **L. Majumdar**, A. Das, S. K. Chakrabarti, S. Chakrabarti, *Hydro-chemical study of the evolution of interstellar pre-biotic molecules during the collapse of molecular clouds*, 2012, **Research in Astronomy and Astrophysics**, 12, 1613 [\[URL\]](#).

**Submitted  
Journal  
Publications**

1. T. Suzuki, Y. Shinnaka, T. Shibata, Y. Shilbaïke, **L. Majumdar**, H. Nomura, H. Minamoto, *Possibility of condensation of glycine near the surface of comet 67P/C-G*, 2019, **The Astrophysical Journal**, arxiv: 1901.05170 [\[URL\]](#).
2. V. Wakelam, P. Gratier, C. Vastel, M. Ruaud, R. Le Gal, **L. Majumdar**, J.-C. Loison, K. Hickson, *Chemical poor cold cores*, 2019, MNRAS

**Publications in  
Preparation**

1. **L. Majumdar**, Y. Seo, P. F. Goldsmith, K. Willacy, E. Bergin, D. C. Lis, *Probing Density, Kinematics, and Chemistry of Fragmenting Core Candidate L1495AN*, 2019, to be submitted in **The Astrophysical Journal Letters**.
2. **L. Majumdar**, K. Willacy, E. Bergin, G. G. Bryden, N. Turner, W. D. Langer, P. F. Goldsmith, M. Ressler *Chemical composition and physical properties of gases and volatiles in a planet forming disk with ALMA*, 2019, to be submitted in **The Astrophysical Journal**.
3. **L. Majumdar**, E. Herbst, V. Wakelam, *An updated 3-phase gas-grain chemical model of spin-kinetics*, 2019, to be submitted in **The Astrophysical Journal**.

**Publications in  
Proceedings/NASA  
ADS**

1. **L. Majumdar**, V. Wakelam, P. Gratier, E. Caux, J.-C. Loison, K. Willacy, *Possibility of protostellar inheritance of organics to Jupiter-family comet 67P/C-G*, 2018, **cosp**, 42, 2130
2. **L. Majumdar**, V. Wakelam, P. Gratier, E. Caux, K. Willacy, M. Ruaud, C. Vastel, A. Dutrey, S. Guilloteau, *An extended public deuterium fractionation model for the astrochemical community*, 2018, **cosp**, 42, 2131

3. **L. Majumdar**, V. Wakelam, P. Gratier, E. Caux, J.-C. Loison, K Willacy, *The chemical link between comet 67P/C-G and low mass protostar IRAS 16293-2422: Integrative Studies in Observational Astronomy and Chemical-Dynamical Modeling*, 2018, **cosp**, 42, 2132
4. **L. Majumdar**, V. Wakelam, P. Gratier, E. Caux, K. Willacy, M. E. Ressler, *Chemistry in Protostellar regions: New implications for JWST MIRI/NIRSpec*, 2018, **cosp**, 42, 2133
5. T. Suzuki, M. Ohishi, **L. Majumdar**, V. Wakelam, M. Saito, T. Hirota, *An Expanded Gas-Grain Model for Interstellar Glycine*, 2018, **cosp**, 42, 3309
6. P. Gorai, S. K. Chakrabarti, A. Das, **L. Majumdar**, E. Herbst, B. Sivaraman, *Search for Propargyl Alcohol in the Interstellar Medium*, 2018, **cosp**, 42, 1253
7. A. Das, S. K. Chakrabarti, **L. Majumdar**, D. Sahu, *Deuterium enrichment of interstellar dusts*, 2016, **cosp**, 41, 401
8. P. Gorai, S. K. Chakrabarti, A. Das, **L. Majumdar**, D. Sahu, B. Sivaraman, *Search for Deuterated methyl acetate in the ISM*, 2016, **cosp**, 41, 731
9. M. Sil, S. K. Chakrabarti, A. Das, **L. Majumdar**, P. Gorai, E. Etim, E. Arunan, *Computation of Adsorption Energies of Some Interstellar Species*, 2016, **cosp**, 41, 1803
10. **L. Majumdar**, S. K. Chakrabarti, A. Das, *On the detection of different chlorine bearing molecules in ISM through Herschel/HIFI*, 2014, **cosp**, 40, 1949.
11. **L. Majumdar**, S. K. Chakrabarti, A. Das, S. Chakrabati, *Existence of some pre-biotic molecules in and around the Interstellar Medium*, 2014, **cosp**, 40, 1948.
12. **L. Majumdar**, S. K. Chakrabarti, A. Das, *Physics and Chemistry on interstellar dust*, 2014, **cosp**, 40, 1947.
13. **L. Majumdar**, S. K. Chakrabarti, A. Das, S. Chakrabati, *Chemical evolution of life making molecules in extreme environments*, 2014, **cosp**, 40, 1946.
14. **L. Majumdar**, S. K. Chakrabarti, A. Das, *Structure, spectroscopy and chemistry on interstellar dust*, 2014, **cosp**, 40, 1945.
15. A. Das, S. K. Chakrabarti, **L. Majumdar**, D. Sahu, *Chemical composition of interstellar dust*, 2014, **cosp**, 40, 625.
16. A. Das, S. K. Chakrabarti, **L. Majumdar**, D. Sahu, *Co-relation of the degree of Ionization of a molecular cloud with the depletion of the neutral species on the interstellar dust*, 2014, **cosp**, 40, 624.
17. D. Sahu, S. K. Chakrabarti, A. Das, **L. Majumdar**, *Explaining the deuterium fractionation of Water: Modelling and observations*, 2014, **cosp**, 40, 2842.
18. D. Sahu, S. K. Chakrabarti, A. Das, **L. Majumdar**, *Effective formation of simple molecules like  $H_2$ ,  $D_2$ ,  $HD$  on grain surfaces and various consequences*, 2014, **cosp**, 40, 2841.
19. **L. Majumdar**, A. Das, S. K. Chakrabarti, S. Chakrabarti, *Chemical evolution and spectroscopy of some complex molecules which could be treated as the precursor of some bio-molecules in the interstellar medium*, 2013, **IAUS**, 292, 250 [[URL](#)].
20. **L. Majumdar**, A. Das, S. K. Chakrabarti, S. Chakrabarti, *A 2D hydrodynamic simulation coupled to chemical evolution around star forming region: A time dependent study*, 2013, **AIP Conf. Proc.**, 1543, 242 [[URL](#)].

21. **L. Majumdar**, A. Das, S. K. Chakrabarti, S. Chakrabarti, *Quantum Chemical approach to study the spectral properties of some important precursor of bio-molecules*, 2013, **AIP Conf. Proc.**, 1543, 266 [[URL](#)].
22. R. Saha, **L. Majumdar**, A. Das, S. K. Chakrabarti, S. Chakrabarti, *Formation of the nucleobases around the Star forming region*, 2013, **AIP Conf. Proc.**, 1543, 251 [[URL](#)].
23. D. Sahu, A. Das, **L. Majumdar**, S. K. Chakrabarti, *Role of Ambipolar Diffusion towards the chemical evolution of molecular cloud*, 2013, **AIP Conf. Proc.**, 1543, 236 [[URL](#)].
24. **L. Majumdar**, S. K. Chakrabarti, A. Das, S. Chakrabarti, *A quantum chemical approach to set a guideline for the observation of different pre-biotic molecules in the interstellar space*, 2012, **cosp**, 39, 1154.
25. **L. Majumdar**, S. K. Chakrabarti, A. Das, S. Chakrabarti, *Formation of some of the bases of DNA in the interstellar space during the molecular cloud collapse*, 2012, **cosp**, 39,1153.
26. **L. Majumdar**, S. K. Chakrabarti, A. Das, S. Chakrabarti, *Spectral signature and chemical evolution of some complex molecules which could be treated as the precursor of some bio-molecules in the ISM*, 2012, **cosp**, 39, 1152.
27. S. K. Chakrabarti, A. Das, **L. Majumdar**, S. Chakrabarti, *A 2D hydrodynamic simulation coupled with the chemical evolution to study the physics and Chemistry of the ISM*, 2012, **cosp**, 39, 288.
28. S. K. Chakrabarti, A. Das, **L. Majumdar**, S. Chakrabarti, *Synthesis of prebiotic molecules and origin of life*, 2012, **cosp**, 39, 289.
29. R. Saha, S. K. Chakrabarti, A. Das, **L. Majumdar**, S. Chakrabarti, *Effect of photo-dissociation on the composition of the grain mantle*, 2012, **cosp**, 39, 1647.
30. **L. Majumdar**, A. Das, S.K Chakrabarti, S. Chakrabarti, *Chemical Evolution around star forming region: A time dependent study*, 2011, **IAUS**, 280, 400.

#### Publications in Books

1. **L. Majumdar**, *The Interstellar Molecular Complexity.*, 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 [[URL](#)].

#### Publications in White Papers

1. M. Gudipati, S. Milam, A. R. Hendrix, B. Henderson, H. Linnartz, **L. Majumdar**, M. Nuevo, D. M. Paardekooper, E. M. Sciamma-O'Brien, R. Smith, N. Turner, K. Willacy, *From Interstellar Ice Grains to Evolved Planetary Systems: The Role of Laboratory Studies*, *Astro2020: Decadal Survey on Astronomy and Astrophysics*, science white papers, no. 518; *Bulletin of the American Astronomical Society*, Vol. 51, Issue 3, id. 518 (2019)

#### Awarded Grants as a Science Principal Investigator

- **NASA ROSES Emerging Worlds Program (EW) 2018**: “Following the multi-isotope trail to understanding the formation and early evolution of our Solar System” (18-EW18-2-0083) at the level of: 171,928 USD for Year 1; 143,397 USD for Year 2; 190,870 USD for Year 3 (2019-2021).

- **SOFIA Cycle 7 Priority 1 Observing Proposal:** “Where is the Water? In addition to the observing time, I received a grant of 72,700 USD to support my work on the observations.
- **ALMA Ambassador Program 2019:** The North American ALMA Science Center (NAASC) selected me as an ALMA Ambassador 2019 and a 10,000 USD monetary grant was offered in support of my independent research programs as well.

**Accepted Proposals for Observations**

**As Principal Investigator**

- **IRAM 30 meter:** Summer Cycle (2015): “Looking for the Sulfur reservoir in IRAS 16293-2422”
- **ALMA Cycle 3:** “Searching for H<sub>2</sub>D<sup>+</sup> in the circumbinary disk surrounding GG Tau A”
- **IRAM 30 meter:** Winter Cycle (2016): “Ortho-to-Para ratio of H<sub>2</sub>CO as a thermometer for disk chemistry”
- **NOEMA:** Winter Cycle (2016): “Looking for the cold organic reservoir in disks”
- **ARO 12m:** Semester 2017B: “Chemical diversity of starless and protostellar cores”
- **NRO 45m:** Semester 2017: “Survey of a direct amino acid (chiral + non-chiral) precursor NH<sub>2</sub>OH around two low-mass stars”
- **NRO 45m:** Semester 2018: “Phosphorus-bearing molecules in solar-type protostars”
- **NRO 45m:** Semester 2018: “Survey of the interstellar aromatic molecule Benzonitrile (cyclic-C<sub>6</sub>H<sub>5</sub>CN) in dark clouds”
- **ARO12m:** Spring 2018A semester: “Phosphorus-bearing Molecules in Solar-type Protostars: Bridging ARO with JWST and ROSETTA”
- **ALMA Cycle 6:** “Searching for Nitrogen bearing organic Formamide: Bridging the Disk composition with Comet 67P/Churyumov-Gerasimenko”
- **SOFIA Cycle 7:** “Where is the Water”

**JWST Guaranteed Time Observation (GTO)**

- **As Co-Investigator:** “Protostellar Binaries in Perseus”.
- **PI:** Michael E. Ressler
- **Other Co-Is:** Thomas P. Greene; Ewine F. van Dishoeck; Ryan M Lau; Mary Barsony; John Tobin.

**Accepted Proposals for 2020 Decadal Survey**

**As PI**

- **ngVLA Community Studies Program:** “HOCO<sup>+</sup> emission as a diagnostic of planet-forming regions of disks: Bridging ngVLA and JWST”.
- **Other Co-Is:** K. Willacy, P. Goldsmith, W. Langer, G. Bryden, J. Pineda, M. Ressler, Y. Hasegawa, T. Kuiper

**Technical Skills**

**Astrophysics & Planetary Science**

- Reduction and Analysis of Single Dish Telescope Data (IRAM, NRO45, ARO12m, and GBT) using GILDAS.
- CASA for ALMA data analysis.
- DiskFit for line modeling of Protoplanetary Disks.
- LTE/non-LTE Radiative transfer modeling using LIME, Radex and RadLite.
- Line analysis using CASSIS and XCLASS.
- Modeling the physical and chemical environment of dark clouds, protostars and protoplanetary disks.
- JWST Pipelines



### Cosmochemistry & Astrobiology

- Isotopic ratios are keys to understanding the origin and early evolution of the solar system since isotopic fractionation chemistry is highly environment specific and can leave an imprint on solar system bodies. Developer of isotope cosmochemistry modeling network to study the origin of our solar system. See here first public isotope chemical network in the community: <http://kida.obs.u-bordeaux1.fr/networks.html>
- Creating theoretically rotational spectroscopic catalogs for new species (not available either in JPL or CDMS databases) using SPFIT/SPCAT Codes observable using state-of-the-art telescopes.
- Modeling the formation and evolution of amino acids such as glycine, alanine, serine, bases of DNA and RNA during star and planet formation to study origin of life.

### Exoplanetary Science

- Chemical kinetics for exoplanetary atmospheres (on going).
- Inverse retrieval code for exoplanetary atmospheres (on going).

### Programming

- Fortran (Expert), Python (Expert), IDL (Expert), Shell, LATEX, Xmgrace, Gnuplot.

### Honors, Awards and Fellowships

- Virtual Panellists of 2019 NASA Postdoctoral Program (NPP)
- Associate of the Cradle of Life Science Working Group of Square Kilometre Array (SKA)
- Selected as a North American ALMA Science Center's **2019 ALMA Ambassador** from the National Radio Astronomy Observatory (NRAO) (This is a highly prestigious award selected from the postdocs in the entire United States of America).
- 2018 TMT Early-Career Initiative Researcher.
- NASA Post Doctoral Fellowship in 2017.
- 3 Years Post Doctoral Fellowship from **Niels Bohr Institute**, University of Copenhagen, Denmark in 2017 (**Declined**).
- 3 Years Post Doctoral Fellowship from Instituto de Ciencia de Materiales de Madrid (**ICMM**), Consejo Superior de Investigaciones Científicas (**CSIC**), Madrid, Spain in 2017 (**Declined**).
- Reviewer of **NASA Fellowship Applications**.
- Reviewer of **NASA Post Doctoral Grant Applications**.
- Reviewer of Journals- **The Astrophysical Journal Letters; The Astrophysical Journal; Astronomy and Astrophysics; Planetary and Space Science; ACS Earth and Space Chemistry, Astrobiology**.
- Invited for **NASA Panel Member** of Exoplanet Research Program (XRP).
- Invited for **NASA Panel Member** of Astrophysics Research and Analysis Program (APRA)
- Invited for **NASA Panel Member** of Astrophysics Data Analysis Program (ADAP)
- Invited for **ALMA Technical Secretary** position in 2019
- Reviewer of **NASA Future Investigators in Earth and Space Science and Technology (FINESST)** Astrophysics Program
- Reviewer of **NASA Astrophysics Research and Analysis Program (APRA)**.
- Research highlighted in NASA Postdoctoral Program Quarterly Newsletter- Volume 1, Issue 4 - January 2018
- Member of the International Space Science Institute (ISSI)-Bern International Science Team Project- **"From Qualitative to Quantitative: Exploring the Early Solar System by Connecting Comet Composition and Protoplanetary Disk Models."**
- Post Doctoral research highlighted in **Physics Today** which is a publication of the American Institute of Physics with a headline "How an organic molecule forms in space". [\[URL\]](#)
- ngVLA community study support from Nov 8, 2017 to Aug 31, 2018. [\[URL\]](#)



- CNRS Post Doctoral Fellowship under 3DICE ERC Grant.
- Member of the Kinetic Database for Astrochemistry KIDA Team.
- Member of “The Chemistry in Disks (CID) Project” which is an international consortium among the Max Planck Institute for Astronomy (Heidelberg, Germany), Bordeaux Observatory (Bordeaux, France), Institute de Radio astronomie Millimetrique (Grenoble, France), SETI Institute (Mountain View, USA), Institute of Astronomy and Astrophysics (Taiwan, China), Jena Observatory (Jena, Germany), University of Virginia (Charlottesville, USA), and Konkoly Observatory (Budapest, Hungary).
- Member of the LOC of international workshop organised by Kinetic Database for Astrochemistry (KIDA) Team in Paris (May, 2015).
- Cospar Grant for attending COSPAR 2014 in Moscow, Russia.
- IAU Grant from the the International Astronomical Union (IAU) for attending the IAU General Assembly XXVIII in Beijing, China.
- Selected as Grant Recipient Student in the 39th COSPAR Scientific assembly, Mysore.
- IAU Grant from the International Astronomical Union (IAU) for attending the IAU SYMPOSIUM 280 in Toledo, Spain.
- Member of the ACS Astrochemistry Subdivision.
- Ph.D. Research Paper highlighted in **nature India** with title “Space recipe for life making molecules” [\[URL\]](#).
- Research highlighted in **nature India** with title “Heavier hydrogen unveils secrets of protostars” [\[URL\]](#).
- Qualified in GATE Examination.
- Qualified in JEST Examination.
- Prestigious Swami Krishnamayananda Award from the Ramakrishna Mission Residential College (Autonomous), Narendrapur, kolkata, West Bengal for academic performances during all four semesters of M.Sc.
- Gold Medal from the Ramakrishna Mission Residential College (Autonomous), Narendrapur for securing first class first position in M.Sc.

## Invited Lectures

- ‘Tracing the Origin of Planetary Systems with Multi-Wavelength Astronomy’, 31st May 2019 at Centro de Astrobiologia, CSIC, Spain
- ‘Chemical composition and physical properties of gases and volatiles in protostellar envelopes’, 6th May 2019 at Max Planck Institute for Extraterrestrial Physics, Garching, Germany.
- ‘Multi-wavelength Astronomy and the Origin of Planetary Systems’, 5th March 2019 at Institute of Astronomy and Astrophysics, ASIAA, Taipei, Taiwan.
- ‘Astrochemistry and the Origin of the Planetary Systems’, 19th Feb 2019 at NRAO and University of Virginia Joint Colloquium, Charlottesville, USA.
- ‘Building stars, planets and the ingredients for life in space’, 30th Nov 2018 at California State University, Los Angeles, USA.
- ‘Possibility of proto-stellar inheritance of organics to Jupiter-family comet 67P/C-G’, COSPAR 2018, Pasadena, USA.
- ‘Chemistry from Clouds to Disks and chemical composition of Comets, August 2017, NASA Jet Propulsion Laboratory, Pasadena, USA.
- ‘The Kinetic Database for Astrochemistry: Present and Future’, 26th November, 2015, Max Planck Institute for Extraterrestrial Physics (MPE), Garching, Germany.
- ‘Chemical evolution of interstellar medium: Modeling and Observation’, 12th May,

2015, Institut de Recherche en Astrophysique et Planetologie (IRAP), France.

## Contributed Lectures

- Formulation of Three Dimensional Total Variation Diminishing Scheme to solve Hyperbolic system of equations. 1st Dec, 2010, PMSC talk, S.N.Bose National Centre for Basic Sciences, Kolkata, India.
- Quantum chemical approach to study the spectral properties of some important precursor of bio-molecules, 10 July to 13 July, 2012, ASTROCHEM 2012 talk, S.N.Bose National Centre for Basic Sciences, Kolkata, India.
- Formation of some of the bases of DNA in the interstellar space during the molecular cloud collapse, 15 July to 16 July, 2012, COSPAR F3.5 (session: Chemical Evolution of star forming Regions: Observations, Experiment and theory), 2012 talk, Infosys Campus, Mysore, India.
- A quantum chemical approach to set a guideline for the observation of different pre-biotic molecules in the ISM, 17 July to 18 July, 2012, COSPAR F3.2 (session: Prebiotic Chemistry and the Origin of Life), 2012 talk, Infosys Campus, Mysore, India.
- Spectral signature and chemical evolution of some complex molecules which could be treated as the precursor of some bio-molecules in the ISM, 15 July to 16 July, 2012, COSPAR F3.5 (session: Chemical Evolution of star forming Regions: Observations, Experiment and theory), 2012 talk, Infosys Campus, Mysore, India.
- Study the interstellar processes leading to the deuterium enrichment, ISRO Respond Meeting, 2013, PRL, Ahmedabad, India.
- Guidelines for astronomical detections of new complex molecules in the Interstellar Medium, Chemical Evolution and Origin of life, 2013, IIT Roorkee, India.
- Role of interstellar dusts towards the chemical enrichment of the ISM, Light Scattering Techniques and Application to Astronomy and other Areas in S.N.Bose National Centre for Basic Sciences, Kolkata, India from, 19th Nov to 20th Nov, 2013.
- Physics and Chemistry on interstellar dust, 2nd August to 10th August, 2014, COSPAR B0.5 (session: Dust and Rings (in the Solar System and Beyond)), 2014 talk, Moscow, Russia.
- Existence of some pre-biotic molecules in and around the Interstellar Medium, 2nd August to 10th August, 2014, COSPAR B0.6 (session: Astrobiology: Life Signs Detections within Planetary Exploration), 2014 talk, Moscow, Russia.
- On the detection of different chlorine bearing molecules in ISM through Herschel/HIFI, 2nd August to 10th August, 2014, COSPAR E1.8 (session: The Herschel (Far-IR) Heritage: High-z Universe, Star Formation, ISM, Stars, ... ), 2014 talk, Moscow, Russia.
- Chemistry of star forming regions including deuteration: Modelling and Observations, International workshop organised by Kinetic Database for Astrochemistry (KIDA) in Paris, France, 5-7 May, 2015.
- Deuteration and Spin Chemistry in Protoplanetary Disks, CID Meeting in Bordeaux, France, 24 Nov, 2015.
- A new comprehensive astrochemical model including deuteration and nuclear spin state processes, Day of Thesis and Post Docs in LAB Bordeaux, 13th May, 2016.
- Deuterated spin chemistry from cloud to protoplanetary disk: modeling and future observation, EWASS Meeting-session S8 in Athens, Greece, 8th July, 2016.
- The chemical link between comet 67P/C-G and low mass protostar IRAS 16293-2422, The origin of galaxies, stars, and planets in the era of ALMA, Nov 29 to Dec 1, 2017, Caltech, Pasadena, USA.
- Deuterium fractionation from molecular clouds to protoplanetary disks: Modeling and observation, ACS Astrochemistry Meeting, March 18 to March 22, 2018, New Orleans, USA.
- Protonated Carbon Dioxide Emission as a Diagnostic of Planet-Forming Regions of

Disks, Astrophysical Frontiers in the Next Decade and Beyond, June 26-29, 2018, Portland, USA.

- The chemical link between comet 67P/C-G and low mass protostar IRAS 16293-2422, July 2018, Cospar, Pasadena, USA.
- Deuterium fractionation in the ISM: Modeling and observation, July 2018, Cospar, Pasadena, USA.
- Chemistry in protostellar regions: New implications for JWST MIRI/NIRSpec, July 2018, Cospar, Pasadena, USA.

## **Student Supervisor, Teaching and Outreach**

- During my first postdoc at Laboratoire d'astrophysique de Bordeaux, I supervised **Ines Andron** from **University of Bordeaux** for her **Master's Thesis** on the topic of "**Chemical probe to understand the evolutionary phases of the star forming regions**" (Majumdar et al. 2017, MNRAS, 467, 3535; Andron et al. 2018, MNRAS, 481, 5651).
- Currently at the Jet Propulsion Laboratory, I am supervising **Jayden Buttler** from **California State University** for his **Master's Thesis** on "**Physical structure and chemical composition of a class 0 protostars using the Atacama Large Millimeter/sub-millimeter Array (ALMA).**"
- I taught and gave tutorials on **Mathematical Methods in Physics** to undergraduate students at the prestigious Ramakrishna Mission Residential College, Narendrapur, Kolkata, India (Affiliated to University of Calcutta; rank 3rd in India on NAAC list).
- Science demonstrations in 18th West Bengal Science Congress (2011), Kolkata, India.
- Science demonstrations in 100th Indian Science Congress (2013), Kolkata, India.
- Assistant in the Annual Laboratoire d'astrophysique de Bordeaux, France JPO Science Festival.
- Research highlighted in Indian Best National News Paper "**The Hindu**" with a headline "**Life from the stuff between the stars**" [\[URL\]](#).
- Research highlighted in Indian Best National News Paper "**The Telegraph**" with a headline "**Seed of Life**" [\[URL\]](#).