



The Author



Partha Sarathi Jena

About Him:

Mr. Partha Sarathi Jena is working as a senior research fellow in the geosciences division. His research interest is understanding paleoclimatic and paleomagnetic processes using cosmogenic nuclides. He did his BSc at Ravenshaw University, Odisha, and MSc at IIT Bhubaneswar



¹⁰Be depositional flux variation in the Central Indian Ocean during the last 43 kiloyears

(Partha Sarathi Jena, Ravi Bhushan, Shivam Ajay, Nisha Bharti, A K Sudheer)

Beryllium-10 (¹⁰Be) is produced in the atmosphere by the interaction of cosmic-ray particles with oxygen and nitrogen. Cosmogenic nuclide (i.e., ¹⁰Be) production depends upon the incoming cosmic ray flux, which is a function of geomagnetic field intensity. Hence, variation in cosmogenic nuclide concentration can be used as a proxy to understand paleomagnetic field strength changes. However, the question arises of how well the sediment core-derived cosmogenic nuclide records (which can be modulated by local processes) represent atmospheric ¹⁰Be production rate. The present study addresses such scientific points with ¹⁴C and ¹⁰Be measurements from a central Indian Ocean sediment core (SK-312/09).

The calculated ¹⁰Be depositional flux during the Holocene varies between 9.63 to 13.01 x 10⁵ atoms/cm²/yr, which is 2-28 % lower compared to the modeled depositional flux for the region. The difference observed in ¹⁰Be depositional flux could be due to local processes (such as boundary scavenging, changing rate of sediment deposition at the location) affecting ¹⁰Be deposition into the sediment column or offset associated with the model estimations. The changes in ¹⁰Be depositional flux and the ¹⁰Be/⁹Be ratio have been reconstructed up to 43 ka. An increase in the ¹⁰Be/⁹Be ratio during 28 to 43 ka is observed due to the lower geomagnetic field intensity during the period. A high-resolution ¹⁰Be/⁹Be ratio reconstruction shows a peak at 41.2 ka, which can be attributed to the Laschamp event. During the Laschamp event, a 60% increase in the ¹⁰Be/⁹Be ratio was observed due to an increase in the ¹⁰Be production rate.

This study being the first from the central Indian Ocean region, addresses local processes affecting the ¹⁰Be deposition into the sediment column and attempts to reconstruct paleomagnetic intensity changes with ¹⁰Be/⁹Be ratio measured from the sediment core. This study paves the way for further understanding of paleomagnetic strength reconstruction using beryllium isotopic measurement from various archives (i.e., sediment and ice cores).

Reference: <https://doi.org/10.1016/j.scitotenv.2021.149808>

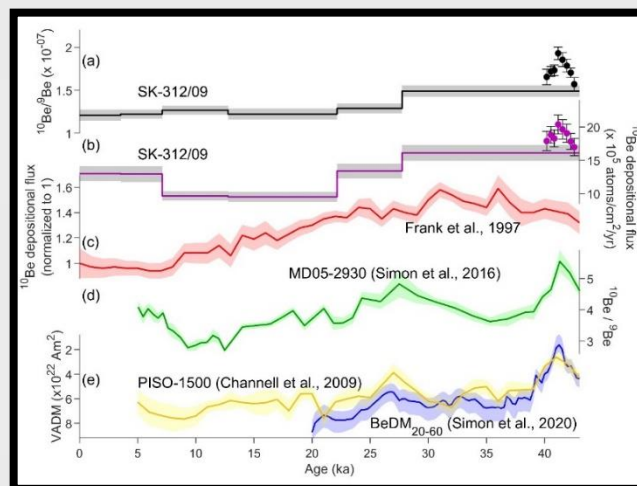


Figure Caption: The temporal variation in (a) ¹⁰Be/⁹Be ratio in core SK-312/09 and (b) ¹⁰Be depositional flux in core SK-312/09 (obtained using method 1; corrected for leaching yield), (c) highly resolved global average ¹⁰Be depositional flux (normalized to 1) by (Frank et al., 1997), (d) ¹⁰Be depositional flux variation obtained from MD05-2930 (Simon et al., 2016b), and (e) virtual axial dipole moment (VADM) record (Channell et al., 2009; Simon et al., 2020).

The Author



Vishal S.
Ngairangbam

About Him:

Mr. Vishal S. Ngairangbam is Senior Research Fellow at Theoretical Physics Division. His research interest is understanding the fundamental particles and their interaction in nature. He has expertise in fast-evolving machine learning techniques.



Detecting anomalous jets with graph autoencoders

(Oliver Atkinson, Akanksha Bhardwaj, Christoph Englert, Vishal S. Ngairangbam, and Michael Spannowsky)

The search for new particles at the Large Hadron Collider (LHC) is an ongoing quest. One of the most commonly found objects at LHC is collimated sprays of highly energetic hadronic particles called jets. These jets are produced in abundance in the already known Quantum Chromodynamics (QCD) domain of the Standard Model of particle physics. Still, they can originate from a heavier particle decay, either from a class of known particles or a completely new one, yet to be discovered. These jets arising from new particles are expected to be very rare. Still, they differ in structure from the usual QCD ones.

Machine learning is an integral element of artificial intelligence (AI) that uses algorithms to learn (features), utilising the data itself and gradually improving its accuracy. Since we are interested in looking into the 'new' jets from many different new physics scenarios with differing signatures, unsupervised learning techniques have been proposed. A class of such methods is the so-called auto-encoders, which effectively learns the standard features. We propose a graph auto-encoder network to understand the structure of the QCD jets and thereby classify any jets with distinct structures as anomalous. Such a network can identify yet-not-seen signals efficiently. The figure illustrates the performance of the network for a few benchmark signals encompassing a wide variety of possible scenarios.

Reference: [https://doi.org/10.1007/JHEP08\(2021\)080](https://doi.org/10.1007/JHEP08(2021)080)

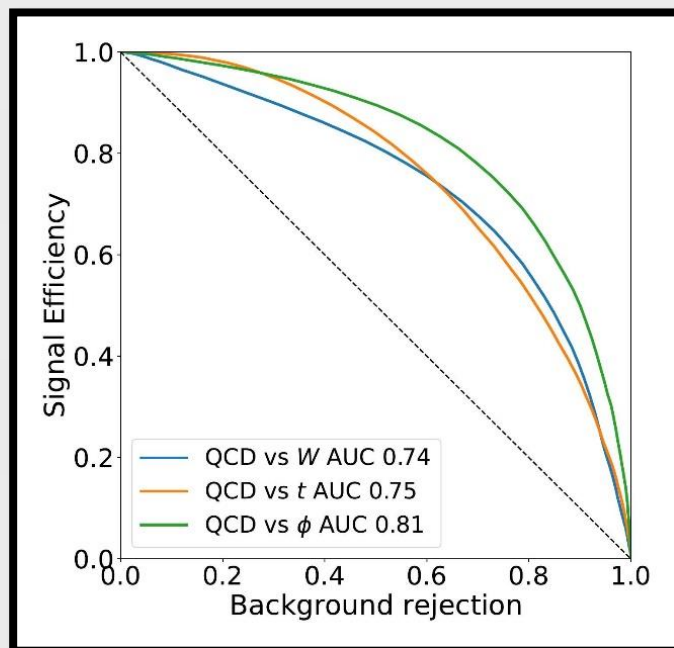


Figure: The receiver operating characteristic (ROC) curve shows the performance of a classification model for three benchmark jet signals. Two-prong (w), three-prong (t) and three-prong (ϕ) signal classes are compared with standard QCD jets.



Venus Science Conference 2021

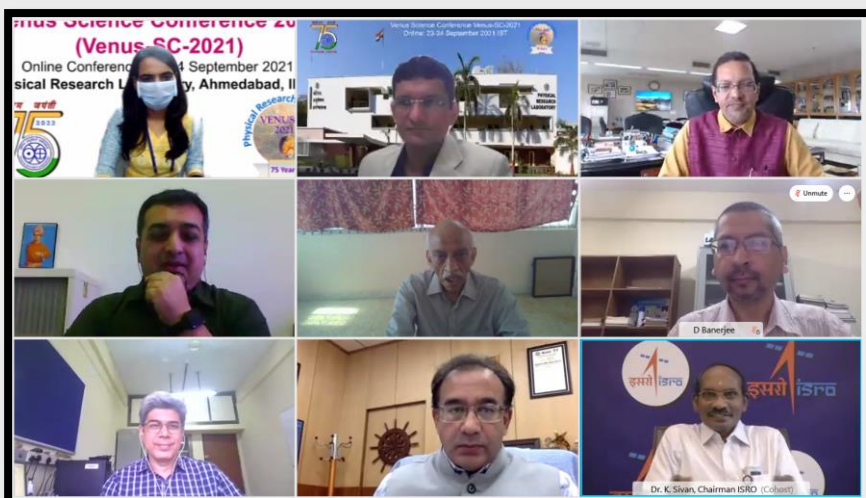


As a part of PRL's Platinum Jubilee celebration, the Planetary Science Division of PRL organised a two day online meeting "Venus Science Conference 2021" during 23-24 September 2021. It focused on modelling, observations, data analysis, and scientific experiments for Venus exploration. The major research areas covered in the conference were surface, atmosphere, clouds, GCM, lightning, airglow, habitability, chemistry, ionosphere, interplanetary dust, IMF, and solar wind interaction with the planet. Such gathering provided an opportunity to interact among the community over the globe and also, collaborate with people working in similar fields over a period of time. About 150 delegates from National and International Institutes attended the Conference.

There were six sessions covering research areas like Global Geological Mapping, Surface Emissivity, VAMAN Project, Atmosphere Dynamics and Turbulence, Oxygen Airglow, Venusian Lightning, Sulfur Chemistry, Habitability of Clouds, Venus GCM, Results from Akatsuki Radio Science Experiment, Ionospheric Layers, Venusian Plasma Environment, Interplanetary Dust Towards Venus and BepiColombo flyby Results. The session chairs were from various ISRO centres. There were about 60 talks including short presentations and the discussions covered a wide spectrum of topics.

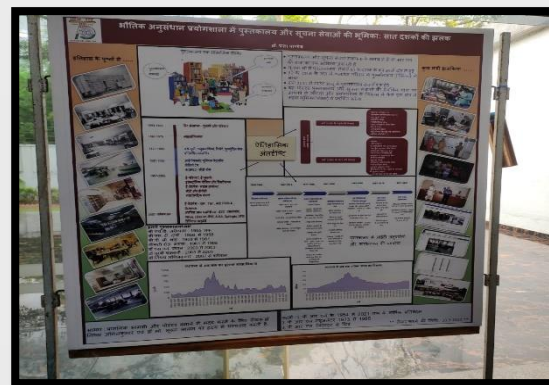
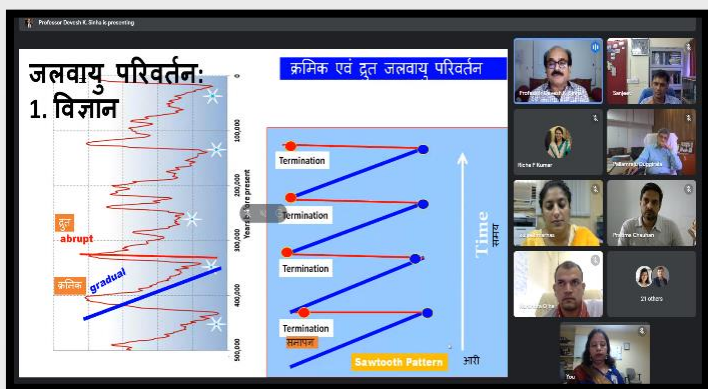
Participation for this conference was from eminent universities/institutes from India covering NISER, SAC, PRL, NARL, SPL, IISER, IIRS, IITB, IPR, IIST, BMSIS, MSU and IIGM. Also, there were several contributions from countries like the US, Germany, Australia, France, UK, Japan, Sweden, Norway, Taiwan and Russia.

Shri A. S. Kiran Kumar (Council Chair, PRL), Dr. K. Sivan, (Chairman ISRO; Secretary, DoS) and Dr. Anil Bhardwaj (Director, PRL) graced the inaugural session. There was a concluding session at the end of the conference. The conference was convened by Dr. Jayesh Pabari and his team. Dr. D. Pallamraju (Dean, PRL), the SOC and LOC members, Dr. Bhushit Vaishnav (Head, Academic Services), Shri Dinesh Mehta, IT team, opted members, electrical team and other members contributed immensely towards making this conference a successful one.



Hindi Pakhwada 2021 Celebrations at PRL

Like every year, PRL celebrated ‘Hindi Pakhwada’ with great enthusiasm. The events related to the Pakhwada started on 14th September and finished on 1st October, 2021. All four campuses were involved in series of programs to encourage staff members to communicate and work in Hindi. A number of programs were carried out in hybrid mode where participants and committee members were in the auditorium with online viewers. The celebration started with an Inaugural lecture by Prof. Devesh Kumar Sinha from the Delhi University, who spoke on some interesting aspects of climate change. Due to his eloquence and colloquial presentation, the lecture received an overwhelming response with more than 100 members joining online. Due to hybrid mode and to provide a new and different flavour to the celebration, some regular programs were modified. Keeping in mind the 75th year of PRL, the ‘Hamara Karya’ was replaced by a poster competition, where the theme was to showcase the evolution of different divisions through time in PRL. With full of enthusiasm, each division presented an informative and beautifully designed poster. The response for ‘Laghu Natika’ was nothing short of professional in every sense. Each division made a short feature film, which was presented in the auditorium with all the participants. The effort of all the divisions received widespread appreciation from the audience for their content, acting, and direction. Apart from the above-mentioned programs, regular programs such as ‘Aashu Bhashan’, ‘Samachar Pathan’ etc. were also arranged. Aashu Bhashan, which was carried out only in online mode, had a new twist with topics to be guessed based on pictures shown on slides. An attempt was made to modify another popular program ‘Shabd Prashnottari’ with many new rounds such as, Know Your Colleagues (KYC), Emoji, and PRL@75. ‘Swarachit Kavita’ by PRL members showed a more serious and emotional turn this year, which reflected the natural reactions to the prevailing uncertain situation that everyone found themselves in due to COVID. Overall, the ‘Hindi Pakhwada 2021’ was a grand success, which was thoroughly enjoyed by everyone in PRL. The Director and Dean were also present for most of these programs and provided constant encouragement throughout. A special care was taken to maintain the COVID protocols and guidelines during the celebration.





Frontiers in Geosciences Research Conference (FGRC-2021)



Geosciences Division of PRL organized its first annual Frontiers in Geosciences Research Conference FGRC-2021 during 27-28 September 2021 in online mode. The objectives of the conference were to highlight the recent advances in understanding various Earth System processes and their linkages through new studies and results. Besides, the other primary aim of this conference was to create a long-term platform for geoscientists of India to jointly address scientific and societal issues and increase collaborative research among researchers from various institutes/universities in India. Going forward, the conference will become an annual event preferably with in-person attendance in future.

The conference was officially inaugurated by Prof. Anil Bhardwaj, Director PRL, who welcomed the conference participants and discussed the legacy and contribution of PRL scientists in the field of geosciences. The inaugural address was delivered by Shri A. S. Kirankumar, Chairman, PRL Council. The delegates were further welcomed by Prof. R. D. Deshpande, Chairman, Geosciences Division, PRL, who also provided the opening remarks for the conference inauguration.

The conference was divided into four broad scientific themes: (i) Solid Earth and Earth Surface Processes, (ii) Marine and Terrestrial Biogeochemistry, (iii) Paleoclimate and Isotope Hydrology and (iv) Aerosols, Air Quality and Ocean-Atmosphere Coupling. Each session was initiated with a plenary talk by an eminent scientist in their research field. The plenary talks during the conference were delivered by Prof. J. S. Ray (NCESS, Thiruvananthapuram), Prof. Sunil K. Singh (NIO Goa), Prof. R. D. Deshpande (PRL, Ahmedabad) and Prof. S. N. Tripathi (IIT Kanpur). Following these plenary talks there were three invited talks in each session, delivered by renowned researchers working in Earth system sciences. Further, several researchers delivered contributory oral talks in the conference. In total, there were 43 oral presentations. In addition, there were two Flash talk sessions (one on each day of the conference), mostly by MSc/MTech and PhD students affiliated to various universities and institutes in India. These participants also contributed with posters on their scientific work, which were displayed on the conference website. Based on the presentation and scientific content of the posters and flash talks, the best four presentations were awarded cash prizes and certificates. In total, there were 54 poster and Flash talk presentations at the conference. The penultimate session of the conference was a career guidance program delivered by Prof. R. D. Deshpande. This session was primarily aimed at highlighting various challenges faced in research and opportunities available in India and abroad to MSc/MTech and PhD students, postdocs and early career researchers. In the final session of the conference there was a discussion in various highlights of the conference by the delegates. Further, several ideas were explored by the delegates to improve the next version of the conference.

In total, 193 participants registered for the conference, and 100 scientific papers were presented as plenary/invited talks, contributory talks and poster/flash talks. With the success of the inaugural FGRC-2021, we look forward to the next version of the conference on a larger scale.

A snapshot taken during the conference is presented below:



Monthly Publications Digest of PRL

1. Gandhi, U., Khatri, N., Brahabhatt, V., Jha, A. K., Patel, A., and Rastogi, N, 2021, [Health impact assessment from exposure to trace metals present in atmospheric PM10 at Ahmedabad, a big city in western India](#), Environmental Monitoring Assessment, *Date of Publication: 30/09/2021*
2. Amzad H. Laskar and A. Bohra, 2021, [Impact of Indian Summer Monsoon Change on Ancient Indian Civilizations During the Holocene](#), Frontiers in Earth Science, *Date of Publication: 06/09/2021*
3. Rajiv R. Bharti, Isaac B. Smith, S.K. Mishra, N. Srivastava, Shital H. Shukla, 2021, [SHARAD detection of sedimentary infilling within an unnamed crater near Mangala Fossa region, Mars](#), Icarus, *Date of Publication: 21/09/2021*
4. Ramakant R. Mahajan, Shuhrat A. Ehgamberdiev and Sekhar Naik, 2021, [Noble gases and nitrogen in CV3 chondrite Bukhara](#), Planetary and Space Science, *Date of Publication: 02/09/2021*
5. Binal D. Patel, Bhuwan Joshi, Kyung-Suk Cho, Rok-Soon Kim, 2021, [DH Type II Radio Bursts During Solar Cycles 23 and 24: Frequency-Dependent Classification and Their Flare-CME Associations](#), Solar Physics, *Date of Publication: 29/09/2021*
6. Wageesh Mishra, Urmi Doshi and Nandita Srivastava, 2021, [Radial Sizes and Expansion Behavior of ICMEs in Solar Cycles 23 and 24](#), Front. Astron. Space Sci., *Date of Publication: 13/09/2021*
7. Anjan S. Josphipura, Ketan M. Patel, 2021, [Weak scale right-handed neutrino as pseudo-Goldstone fermion of spontaneously broken \$U\(1\) \times \[L \times \mu-L \times \tau\]\$](#) , JHEP 09 (2021) 115, *Date of Publication: 20/09/2021*
8. Guru Prasad Kadam, Hiranmaya Mishra, Marco Panero, 2021, [Critical exponents and transport properties near the QCD critical endpoint from the statistical bootstrap model](#), The European Journal of Physics C81, 795, (2021), *Date of Publication: 07/09/2021*
9. Neeraj Kumari, M. Pal, Sachindra Naik, Arghajit Jana, G. K. Jaisawal and P. Kushwaha, 2021, [Complex optical/UV and X-ray variability in Seyfert 1 galaxy Mrk 509](#), PASA, 38, 42, *Date of Publication: 16/09/2021*
10. Arghajit Jana, Sachindra Naik, D. Chatterjee, Gaurava K. Jaisawal, 2021, [NuSTAR and Swift observations of the extragalactic black hole X-ray binaries](#), Monthly Notices of the Royal Astronomical Society, 507, 4779-4787, *Date of Publication: 16/09/2021*
11. T. Aoki, R. Sreekantham, B. K. Sahoo, Bindiya Arora, A. Kastberg, T. Sato, H. Ikeda, N. Okamoto, Y. Torii, T. Hayamizu, K. Nakamura, S. Nagase, M. Ohtsuka, H. Nagahama, N. Ozawa, M. Sato, T. Nakashita, K. Yamane, K. S. Tanaka, K. Harada, H. Kawamura, T. Inoue, A. Uchiyama, A. Hatakayama, A. Takamine, H. Ueno, Y. Ichikawa, Y. Matsuda, H. Haba, and Y. Sakemi, 2021, [Quantum sensing of the electron electric dipole moment using ultracold entangled Fr atoms](#), Quantum Sci. Technol. 6, 044008 (2021) (<https://doi.org/10.1088/2058-9565/ac1b6a>), *Date of Publication: 10/09/2021*

PRL ka Amrut Vyakhyaan



1. 27.10.2021 - What are exoplanets made of? Molecular line lists to aid the characterisation of exoplanets, delivered by Prof. Jonathan Tennyson FRS Massey. He is the Professor of Physics and Head of Department at the Department of Physics and Astronomy, University College London (UCL), Chief Scientist, Quantemol Ltd, UCL.
2. 20.10.2021 - Earth system science for socio-economic benefits, delivered by Dr. M. Rajeevan. He was the Former Secretary of the Ministry of Earth Sciences, Govt. of India.
3. 13.10.2021 - The mystery of venus lightning, delivered by Dr. Ralph Lorenz. He is the Planetary scientist and Engineer at the Johns Hopkins Applied Physics Lab, Maryland, USA.
4. 06.10.2021 - A song for the sol, delivered by Dr. Madhulika Guhathakurta. She is a Senior Advisor for New Initiatives, Heliophysics and NASA GSFC/HQ Program Scientist.
5. 29.09.2021 - Dynamics of aurora and airglow in the upper atmosphere and space around the earth delivered by Prof. Kazuo Shiokawa from the Institute for Space-Earth Environmental Research, Nagoya University, Japan.
6. 22.09.2021 - Prospects in solar physics for the next decade: a multi-messenger era delivered by Dr. Valentin Martinez Pillet. He is the Director of the National Solar Observatory (NSO) Boulder, USA.
7. 15.09.2021 - Green energy and clean water from the oceans , delivered by Dr. Purnima Jalihal. She is Scientist G & Head of Energy and Fresh Water department at the National Institute of Ocean Technology, Chennai, India.

Awards & Honors

Prof. Kuljeet K. Marhas, Professor, Planetary Sciences Division of PRL has been awarded SERB-POWER Fellowship. SERB-POWER (Promoting Opportunities for Women in Exploratory Research) Fellowship is an initiative for empowering Indian women researchers in Science, Technology and Innovation (STI). The award consists of a grant of Rs. 10 lakh p.a for 3 years. Hearty Congratulations to Dr. Marhas for her accomplishment!

Hearty Welcome to new members



Name : DR. SHASHI PRABHAKAR
Designation : Assistant Professor
Date of Joining : 15.09.2021
Division/Area : Atomic Molecular & Optical Physics

Name : DR. SATYENDRA NATH GUPTA
Designation : Assistant Professor
Date of Joining : 15.09.2021
Division/Area : Atomic Molecular & Optical Physics



Obituary



Late Shri A.V. Bagayatkhar
Special Assistant to Director
11.12.1932 to 04.08.2021
Date of retirement: 31.12.1990

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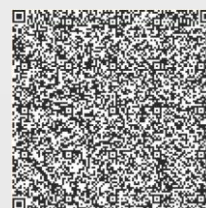
<https://www.prl.res.in/prl-eng/home>



website-Hindi



website-English



PRL-Contact

Physical Research Laboratory

(A unit of Dept. of Space, Govt. of India)
Navrangpura, Ahmedabad - 380009
Phone: (079) 26314000
Fax: (079) 26314900
E-Mail: director@prl.res.in

भौतिक अनुसंधान प्रयोगशाला
(भारत सरकार, अंतरिक्ष विभाग की यूनिट)
नवरंगपुरा, अहमदाबाद - 380009
दूरभाष: (079) 26314000
फैक्स: (079) 26314900
ई - मेल: director@prl.res.in

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