Newsletter of the Physical Research Laboratory

THE SPECTRUM

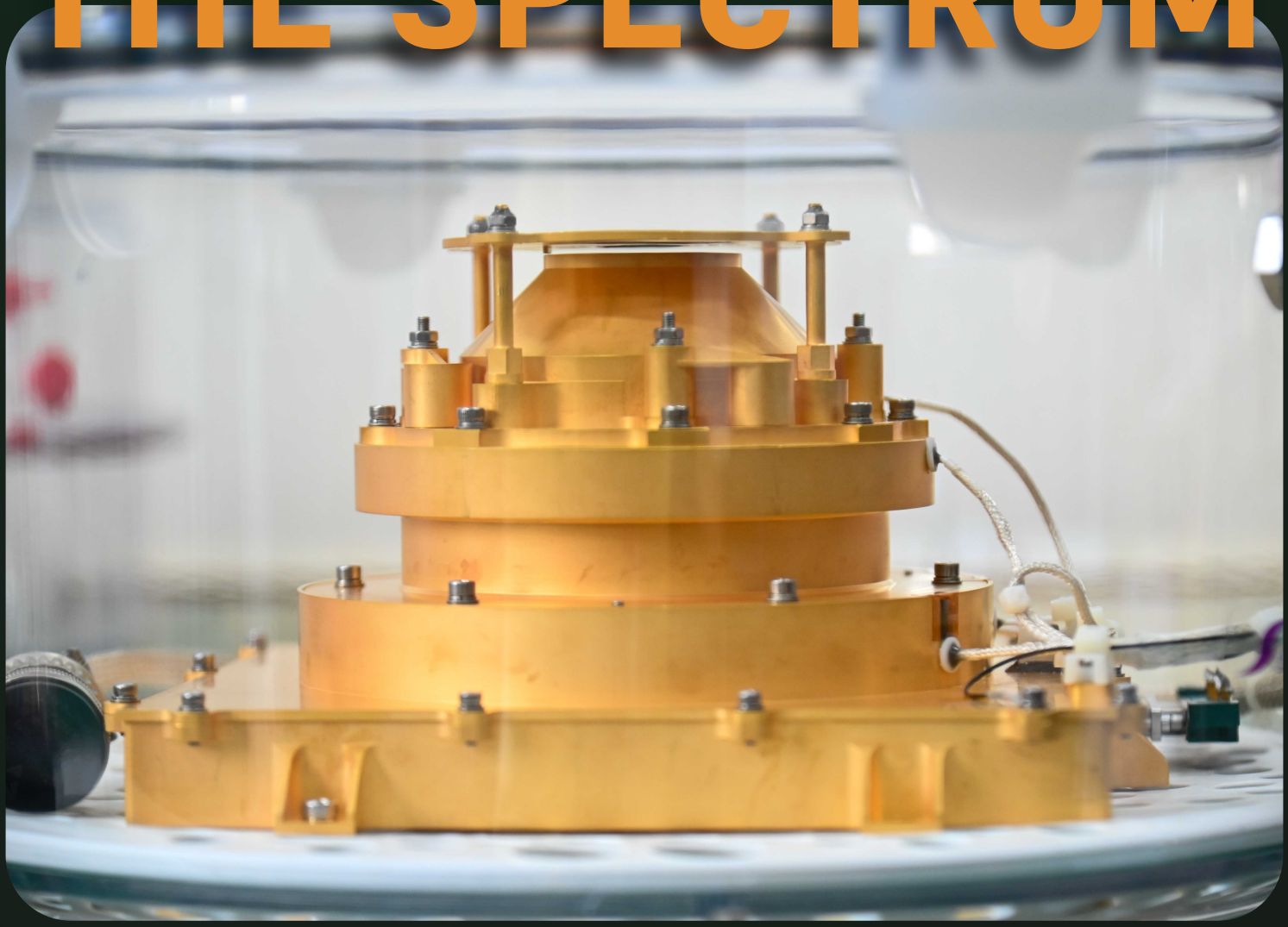


Image of the Month

Top-hat analyzer-1 (THA-1), one of the sensor units of **Solar Wind Ion Spectrometer (SWIS)** subsystem of **Aditya-L1 Solar wind Particle Experiment (ASPEX)** payload onboard **Aditya-L1** spacecraft.
THA-1 will observe ions coming in the ecliptic plane and has the capability to measure angular and mass distributions simultaneously in 100 eV - 20 keV energy range.

February 2023 Issue

What's Inside?

The Author

Vineet Goswami

Impact of suboxic coastal water conditions on Mo isotopic composition (δ^{98}Mo) in northern Bay of Bengal

(***Vineet Goswami***, *Sunil K. Singh, Ravi Bhushan, Vinai K. Rai)*

Molybdenum is the most abundant transition metal in the ocean and plays important role in regulating several biogeochemical processes (e.g., nitrogen fixation). Further, due to its linkage with the redox transformations, Mo isotopic composition (defined as δ^{98}Mo) can be used as an excellent tracer to understand past oceanic redox changes. The Mo isotopic composition of seawater at any point of time depends on its various sources and sink to/from the ocean. The dissolved riverine supply is the most dominant source of Mo in the ocean. Thus, changes in Mo isotopic composition of the riverine supply can influence the seawater Mo isotopic composition. Based on the analysis of few crustal materials (granites, clastic sediments), it has been estimated that average Mo isotopic composition of the Earth's crust is very close to 0‰. However, the present-day seawater δ^{98}Mo (~ 2.3‰) is significantly heavier than the average continental crustal value. This has been primarily attributed to the large isotopic fractionation of Mo during its adsorption onto Mn nodules and ferromanganese crusts. However, another point to consider that various processes operating in the rivers, estuaries and coastal zones can significantly influence the Mo isotopic composition of input to the ocean. Reductive dissolution of Fe/Mn-(oxyhydr)oxide phases, and degradation of organic matter notably within high-Mo organic-rich muds in the costal zones can provide lighter than seawater Mo to the coastal waters. To understand all these processes, sediments and seawater samples were collected from the coastal Bay of Bengal region. These collected samples were subsequently analyzed for δ^{98}Mo at PRL.

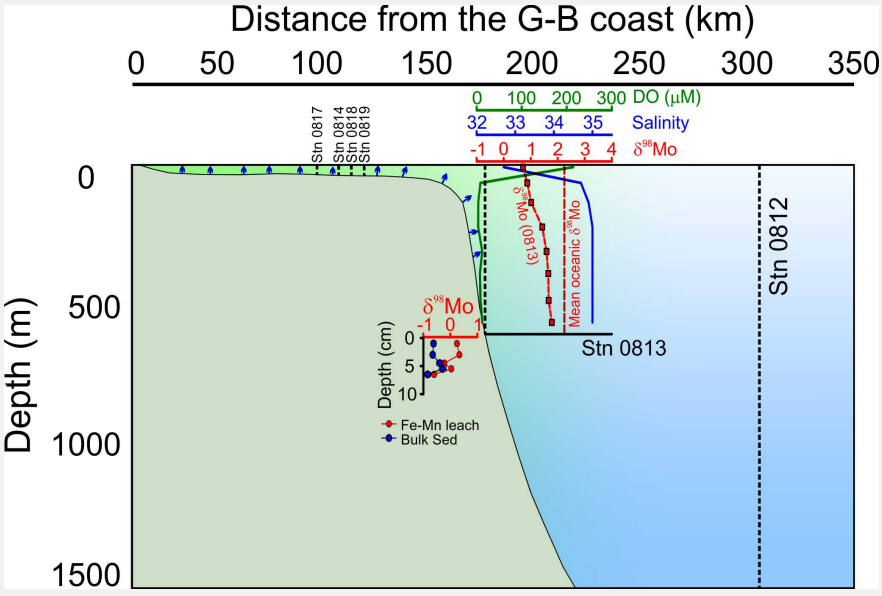


Figure Caption: Release of Mo from dissolution of particulate matter (shown by arrows and light green color) in the Bay of Bengal shelf region leads to depleted/lighter ^{98}Mo in these waters.

The obtained results showed, for the first time, lighter than seawater δ^{98}Mo in the water column of the northern coastal Bay of Bengal (average = 1.64 ± 0.42‰; 1s). Based on the analyses of sediments, it was estimated that around 5–11% of Mo fraction is adsorbed on Fe-Mn oxyhydroxide phase, which can be easily released to the water column under suboxic to anoxic conditions. The lighter δ^{98}Mo in northern coastal Bay of Bengal waters could be due to in- situ reduction and dissolution of Fe-Mn oxyhydroxide phases adsorbed on suspended particulate matter. In addition, dissolution of Fe-Mn hydroxides in the bottom sediments followed by injection of pore water to the water column along the continental margins can also supply lighter Mo to the coastal waters. Repeated cycles of deposition and reductive dissolution of sedimentary Fe-Mn oxyhydroxide phases in the shelf/slope regions could supply lighter Mo to the porewaters. Further, subsequent diffusion/advection of these porewaters to the water column and/or dissolution of Fe-Mn oxyhydroxide phases in the suboxic water column could supply lighter Mo to waters of the northern coastal Bay of Bengal.

Source/Reference of the Work: https://doi.org/10.1016/j.gca.2022.03.010

A Tidally Warped Decretion Disc Causing a Giant X-ray Outburst in the Be/X-ray Binary 1A 0535+262

(***Birendra Chhotaray***, *Gaurava K. Jaisawal, Neeraj Kumari, Sachindra Naik, Vipin Kumar, Arghajit Jana*)

The Author

Birendra Chhotaray

X-ray binaries are one of the brightest X-ray sources in our galaxy. They consist of a compact object (black hole, neutron star, or white dwarf) emitting in X-rays and a companion star which is in the process of evolution. In the Be/X-ray binaries (BeXRBs), the optical companion is an Oe/Be star that shows emission lines in the optical/infrared spectrum and infrared excess, unlike classical stars that show absorption lines and no infrared excess. Be stars' unique properties are ascribed to the equatorial circumstellar disc around them. In BeXRBs, the compact object, a neutron star, emits X-rays by accreting matter from the decretion disc. These systems show two types of X-ray outbursts: normal ($L_X < 10^{37}$ erg s^{-1}) and giant ($L_X > 10^{37}$ erg s^{-1}). The normal outbursts are attributed to the periastron passage of the neutron star. However, the giant outbursts are unpredictable. To understand the mass accretion mechanism during a giant outburst, we studied a BeXRB 1A 0535+262 that went onto a giant outburst in October 2020. We used the data from the MFOSC-P instrument mounted on the 1.2 m telescope at Mount Abu Infrared Observatory to probe the discretion disc before, during, and after the giant outburst. We also used long-term photometry data from the AAVSO international database. In our spectra, the prominent Hα line is found to be significantly variable. The single-peaked Hα line appeared asymmetric with broad red and blue wings before and during the outburst. The post-outburst observations, however, resulted in a double-peaked profile with asymmetry in the blue wing. We fitted the asymmetric Hα line with two Voigt profiles to tally the contribution of the blue and red-shifted components and calculated the equivalent width to measure the strength of the line. From our analysis, we found that the circumstellar disc is highly misaligned. The torque applied by the neutron star on the disc during the periastron passage, causes the disc to precess. As the disc is not a solid object, rings of matter in the disc precess at different rates, which causes the warping of the disc. The neutron star can accrete a sufficient amount of matter required for the giant outburst when the warped region falls towards it. Therefore, the presence of a warped circumstellar disc around the Be star causes the giant X-ray outburst in the Be/X-ray binaries.

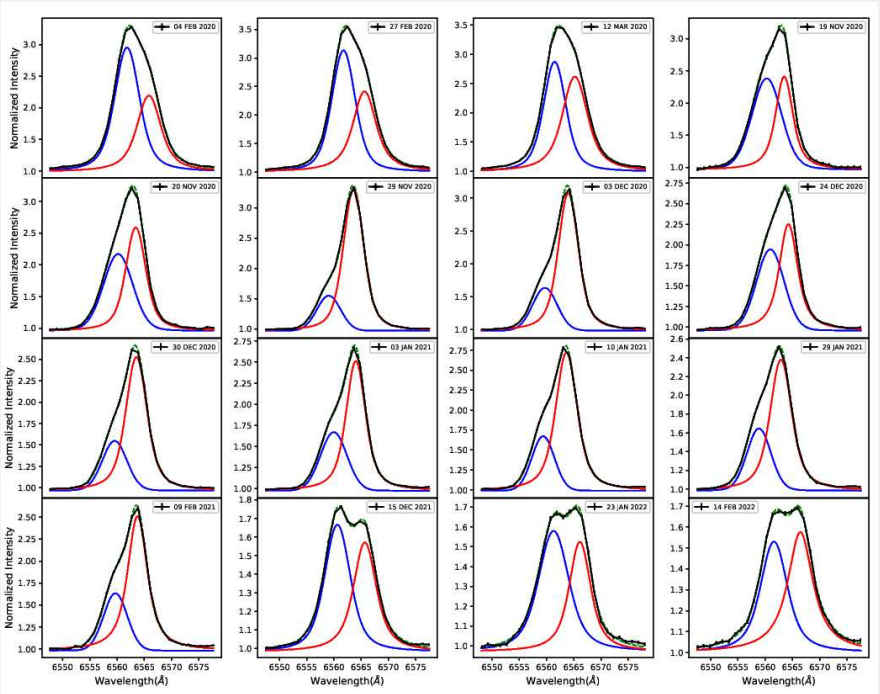


Figure Caption: The Hα line profiles (solid black line) of 1A 0535+262/ HD245770 during our observations and corresponding best-fitted Voigt functions (green line). The observation dates are quoted on the right of the corresponding profiles. The red and blue color profiles correspond to the red and blue shifted components of the Hα line, respectively.

Source/Reference of the Work: https://doi.org/10.1093/mnras/stac3354

The Author

Anupam Ghosh

Top-philic dark matter in a hybrid KSVZ axion framework

(***Anupam Ghosh***, *Partha Konar, Rishav Roshan)*

Diverse Astro-cosmo experiments established undeniable evidence of the existence of yet unknown matter all around our Universe, which significantly dominates over our known fundamental matter particles. Hence the theoretical and experimental search for such dark matter particles is a very active research domain. PRL groups are also pursuing such studies actively. The present work explores a two-component dark matter scenario in an extended version of the axion framework. Axion is a hypothetical particle proposed to solve the strong CP problem in quantum chromodynamics (QCD). It is also a candidate for dark matter. This work focuses on how the vector-like quark in this extension affects dark matter and collider phenomenology. This coloured particle can change the allowed dark matter parameter space by opening new co-annihilation and direct detection channels. Additionally, it creates a unique topology for generating a boosted-top pair with considerable missing transverse momentum at the Large Hadron Collider (LHC), which can test and exclude a vast region of parameter space. LHC is the world's largest and most powerful particle accelerator, located at CERN, the European Organization for Nuclear Research, in Geneva, Switzerland. The LHC experiment accelerates and collides proton beams at very high energy to study the properties of subatomic particles and the fundamental forces of nature.

Source/Reference of the Work: https://doi.org/10.1007/JHEP12(2022)167

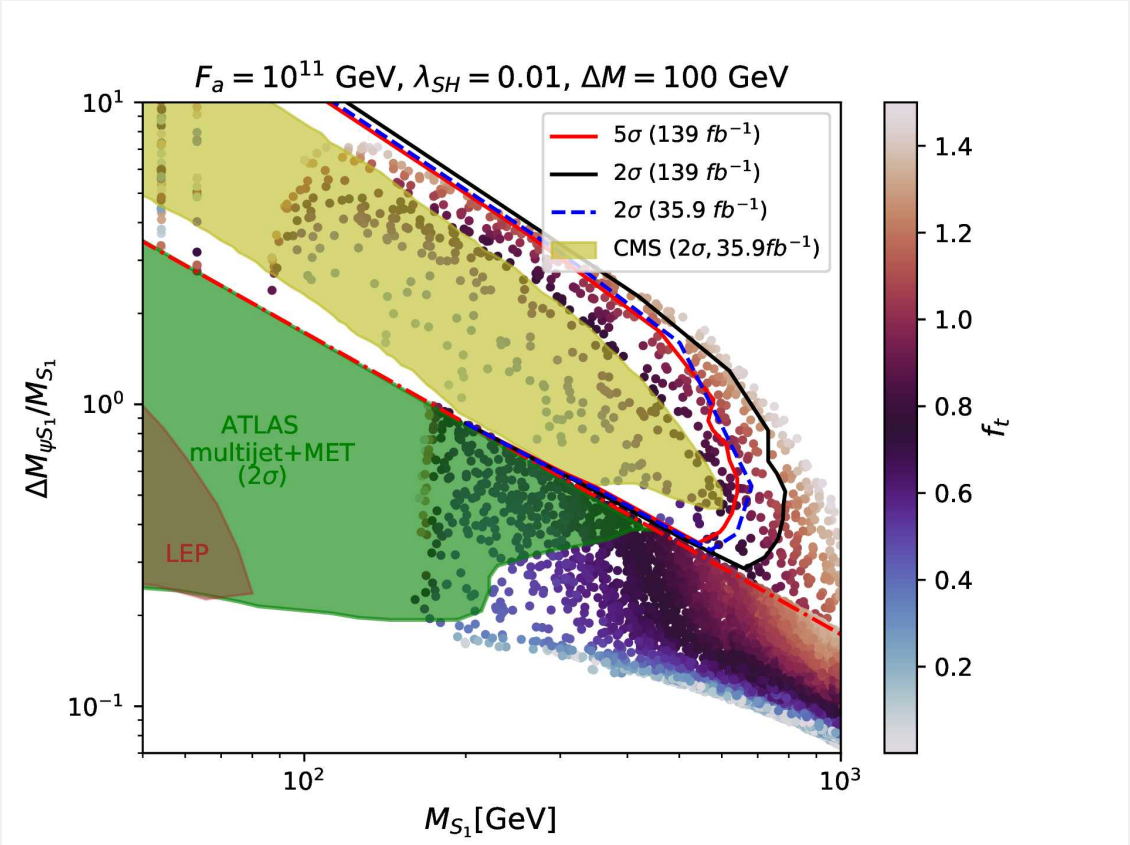


Figure Caption: 5σ discovery contour (solid red), and 2σ exclusion contour (solid black) at 14 TeV LHC for an integrated luminosity 139 fb^{-1} in the bi-dimensional plane are shown. The exclusion region (and 2σ) from the existing LEP, ATLAS (multijet plus missing energy), and CMS (top and anti-top with missing transverse momentum) analysis are shown by brown, green, and olive colours, respectively.

The Author

Himanshu Saxena

Contribution of chemoautotrophy toward CO_2 sink in the ocean

(***Himanshu Saxena***, *Deepika Sahoo, Sipai Nazirahmed, Deepak Kumar Rai, Mohammad Atif Khan, Niharika Sharma, Sanjeev Kumar, Arvind Singh)*

While the photosynthetic assimilation of carbon dioxide (CO_2) by microorganism in the ocean is well recognised for its potential in regulating the climate of the Earth, their chemosynthetic light-independent counterparts remained overlooked. Today, the world is approaching several CO_2 removal mechanisms to remove ~1000 billion tons of atmospheric CO_2 by 2100 by increasing oceanic CO_2 uptake, but the prerequisite estimate of CO_2 sources and sinks is imprecise. The chemosynthetic CO_2 assimilation in the twilight ocean (hereafter, dark C fixation) is one such area of investigation to account in C budget estimates.

The potential of dark C fixation toward CO_2 sequestration has not been tested sufficiently in experiments. We examined the Arabian Sea for its dark C fixation potential and the effect of oxygen (O_2) concentrations on dark C fixation. We additionally measured primary productivity (i.e., photosynthetic C fixation) in the euphotic zone of the Arabian Sea and to that our results hint toward a decrease in primary productivity in the Arabian Sea within the last two decades. We observed that average dark C fixation rates in the suboxic waters (having $[O_2] \leq 20$ µmol kg^{-1}) were higher than that in the hypoxic waters (having $20 < [O_2] \leq 60$ µmol kg^{-1}) (Figure 1), which we attributed to the preferential existence of chemoautotrophic ammonium oxidisers and anammox bacteria owing to nitrite (NO_2^-) maxima in the suboxic waters. Extrapolation of the measured dark C fixation rates to the global ocean ranged up to 7.4 Pg C y^{-1}, that amounts to ~15% of the global ocean primary production. Our study provides quantitative evidence to include dark C fixation rates in the marine C budget estimates.

Source/Reference of the Work: https://doi.org/10.1029/2022GL099044

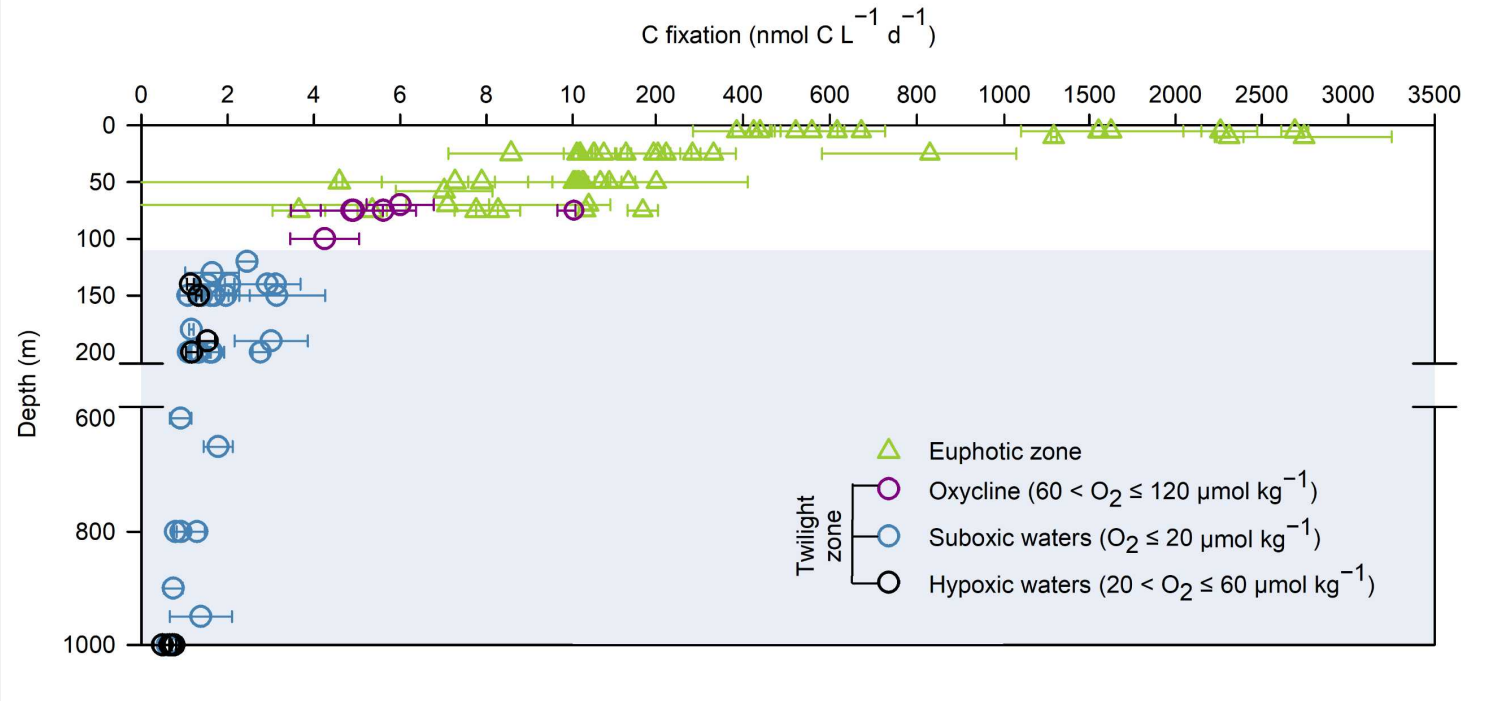


Figure Caption: Vertical profile of C fixation rates in the euphotic and twilight zones. Shaded background indicates the oxygen minimum zone within the twilight zone.

Sustained Heating of the Chromosphere and Transition Region Over a Sunspot Light Bridge

(***Louis, Rohan E.***, *Mathew, Shibu K., Bayanna, A. Raja, Beck, Christian, Choudhary, Debi P.)*

The upper atmospheric layers of the Sun, namely the Chromosphere and Transition Region serve as a conduit for mass and energy between the dense, 6000 K Photosphere and the tenuous, million degree Corona. Understanding the processes that contribute to the heating of the upper atmospheric layers of the Sun is a fundamental problem in Solar Physics. This study combines multi-wavelength observations from the 50 cm MAST, Hinode, IRIS, and SDO to analyze the sustained heating of the chromosphere and transition region above a light bridge in a regular sunspot over a period of days. The signatures of this heating are seen in the temperature maps of the chromospheric Ca II line from MAST and the Mg II line from IRIS, as well as in the peak amplitude and line width of the IRIS C II, Si IV lines that form at a temperature of 30,000K and 65,000K, respectively. The persistent heating over the light bridge is counterintuitive as the underlying structure would radiate the majority, if not all, of its energy once having evolved to a strongly convective region inside the sunspot. The continued heating could be accounted for by one or a combination of the following processes such as the loss of magnetic flux, kinetic energy from the lateral expansion of the light bridge, or freefall acceleration of plasma along coronal loops.

Source/Reference of the Work: https://iopscience.iop.org/article/10.3847/1538-4357/aca612

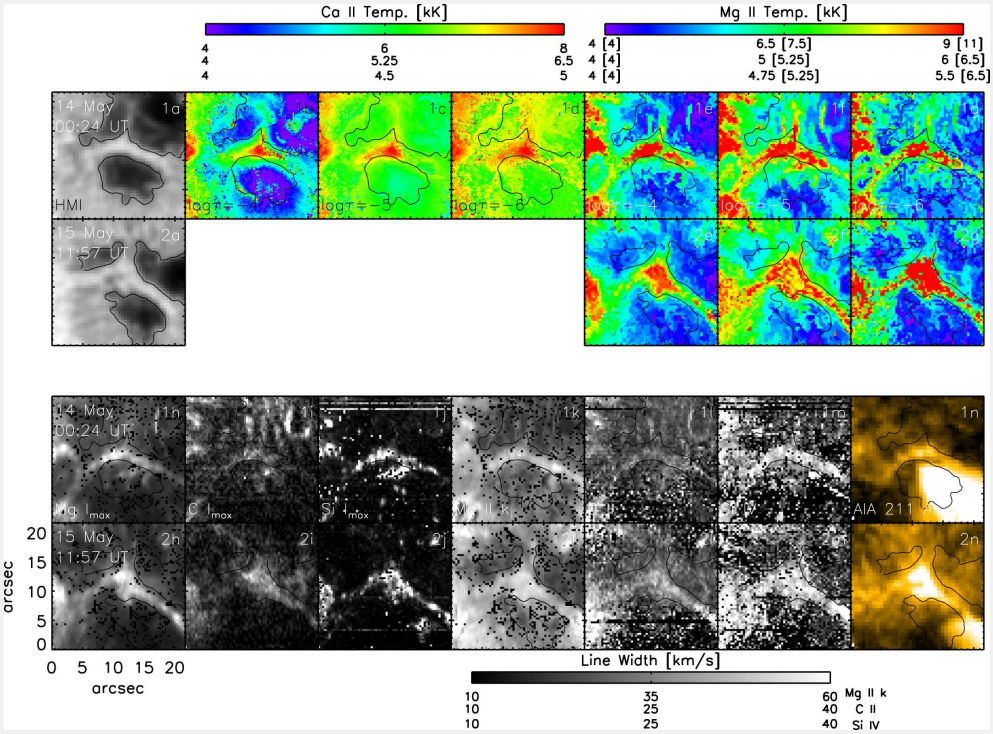


Figure Caption: Maps of temperature, peak intensity, and line width in the LB as a function of height. Top row, from left to right: HMI continuum intensity (panel a), temperature derived from the MAST Ca II line at log τ = -4, -5, -6 (panels b-d), and temperature derived from the IRIS Mg II line at log τ = -4, -5, -6 (panels e-g). The temperature maps have been scaled to the corresponding color bars above the respective panels, with the numbers from the top to the bottom row below the color bar representing log τ =-6, -5, and -4, respectively. The temperature color bar for the IRIS Mg II line is similar, with the numbers in the parentheses corresponding to the observations on 2019 May 15 at 11:57 UT for the maps in the second row. Second row: the same as above on 2019 May 15 at 11:57 UT. Third row: maximum line intensity from the IRIS Mg II line, C II line, Si IV line (panels h-j), line width from the IRIS Mg II line, C II line, Si IV line (panels k-m), and AIA intensity at 171 Å (panel n) on 2019 May 14. Bottom row: the same as above on 2019 May 15 at 11:57 UT. The black contours correspond to the HMI continuum intensity and outline the LB.

The Author

Rohan Louis

The Author

B.K. Sahoo

Highly Charged Ion Clocks to Probe Variation of Fine Structure Constant

*(Yan-Mei Yu, **B. K. Sahoo** and Bing-Bing Suo)*

As suggested by higher dimensional models, unification of gravity with the other three fundamental forces may require space and time variation of some of the dimensionless fundamental constants. In this scenario, probing temporal variation of the electromagnetic fine structure constant (α) in a low energy regime at the cosmological time scale is of immense interest. On the other hand, atomic transition frequencies are being measured to ultra-high precision in the atomic clock experiments. These transition frequencies are functions of α. Measurement of a clock frequency at different temporal and spatial conditions can yield signatures to ascertain variation of α. Therefore, atomic clocks can be used to probe temporal and spatial variation of α. Since orbitals of highly charged ions (HCIs) are heavily contracted, they are least affected by the external stray electromagnetic fields. Again, relativistic effects in HCIs are enhanced drastically. This makes HCI clocks are the ideal platforms for testing possible variation of α.

In the past decade, many HCIs have been proposed as suitable candidates for making ultra-precise atomic clocks, which have highly stable laser-accessible clock transitions, enhanced sensitivity coefficients to variation of α, and advantageous atomic properties to inhibit external perturbations. Based on two basic rules that outline the M1 and E2 forbidden transitions among the fine-structure splitting and the higher order forbidden transitions in the HCIs having complex electronic configurations accompanied with orbital-level crossing, a shortlist of large number of HCI clock candidates are summarized in our review article. It includes Ar^{13+}, Ni^{12+}, Ba^{4+}, Pb^{2+}, Ir^{17+}, Cf^{15-17+}, Nd^{13}, Sm^{15+}, Pr^{9+}, Nd^{9+}, Ho^{14+}, amongst many. The first HCI clock based on Ar^{13+} has been realized now and reached 10^{-17} level frequency uncertainty at the moment. The other ions aside from Ar^{13+} can offer better frequency stability and higher sensitivity to variation of α, exploring new directions for making atomic clocks. Discussions made in our article would help the experimentalists to understand the merits and demerits of the listed HCIs for building various types of atomic clocks and may guide them to search for the variation of α in the near future.

Source/Reference of the Work: https://doi.org/10.3389/fphy.2023.1104848

Source	$\Delta\alpha/\alpha$	Δt (year)	$\dot{\alpha}/\alpha$(year^{-1})
Cosmological	$< 10^{-3}$	10^{10}	10^{-13}
Astrophysical (quasar)	$(2.18 \pm 7.18) \times 10^{-5}$	10^{10}	$(2.18 \pm 7.18) \times 10^{-15}$
Geophysical (Oklo)	$< 1.1 \times 10^{-8}$	2.1×10^{9}	$< 10^{-17}$
Laboratory			$(1.0 \pm 1.1) \times 10^{-18}$

Figure Caption: Comparison of various limits to variation in α with its absolute value (Δα/α) obtained from different types of studies over a time interval Δt. The corresponding present limits in annual fractional rate of change (α̇/α), with a crude assumption of a linear change in time, are also given.

The Author

Tatsat Solanki

An indoor mesocosm experiment for assessing the potential of ocean alkalinity enhancement in removing anthropogenic CO_2

(***Tatsat Solanki***, *Himanshu Saxena, Nazirahmed Sipai, Shreya Mehta, Jitender Kumar, Arvind Singh)*

Since the Industrial Evolution, the CO_2 concentration in the atmosphere has increased tremendously. To keep the global temperature within 2ºC above the pre-industrial era, following the Paris agreement, in addition to the reduction of CO_2 emissions, negative emission techniques must be implemented. Moreover, due to the natural enhanced uptake of carbon dioxide by the ocean, the pH of the ocean has decreased from 8.3 to 8.1 – a phenomenon called ocean acidification. To tackle both of these issues, it has been hypothesized that Ocean Alkalinity Enhancement (OAE) not only can sequester CO_2 from the atmosphere, but also counters Ocean Acidification. However, it is unknown what the effect can be of OAE on marine biology and more specifically on primary productivity when implemented in the open ocean. To mimic enhanced alkalinity conditions and get a clearer picture of the impact on biogeochemical cycles of the ocean by OAE, we conducted an in-door mesocosm experiment at NITTE University, Mangaluru, Karnataka in November 2022.

With a team of six in collaboration with NITTE University, Mangalore, we monitored the evolution in eleven 300 L coastal seawater tank setups dopped with 7 chosen minerals for two target alkalinity changes for 10 days. One tank was set for control without adding any minerals, while seven mesocosms were added with a measured weight of seven minerals, namely olivine, albite, quicklime, calcite. dolomite, magnesite and hydrated lime, to get the ~10% total alkalinity increase. Furthermore, the remaining three tanks had ~20% target alkalinity increase with chosen 3 minerals which are olivine, albite and quicklime. We collected samples for measuring alkalinity, DIC and pH for choosing the best-suited mineral based on the efficiency of CO_2 sequestration. Moreover, the changes in the carbon and nitrogen fixation rates, and Redfield ratio were monitored. Also, to check if certain minerals favor a particular genus, we collected samples for DNA and picophytoplankton. The result of this experiment can give us a glimpse of the answers to the following questions: How feasible this NET (Negative Emission Technique) is? How efficient can this approach be? We will be able to answer these questions in a couple of months when we have all the data with us.

Figure Caption: Setting up the in-door mesocosm experiment at NITTE University, Mangaluru, Karnataka.

The Author

Jayesh P. Pabari

Metallic Ion Layers in Planetary Atmosphere: Boundary Conditions and IDP Flux

(***Jayesh P. Pabari***, *Srirag N. Nambiar, Rashmi and Sonam Jitarwal)*

Ablation of interplanetary dust in planetary atmosphere is a continuous process, resulting in formation of a metallic ion layer at certain altitude. Some past modelling and observational results show layers of metallic ions between ~79-93 km altitudes on Mars. In the present work, we have shown production rates of different species generated due to dust ablation on Mars and Venus, using our ablation model. We used the existing Earth based observations to obtain a scaled dust flux for the orbit of Mars. Also, Galileo observations of dust over a heliocentric distance, covering 1.5 AU, are used to model a new velocity distribution of particles at Mars, as a more practical. As such, any given production rate profile depends on many factors like atmospheric density, temperature, particle velocity, particle mass, dust flux and the error or uncertainty involved. To accommodate all such effects at one place, we have considered extreme cases of atmospheric condition and dust flux for the planet Mars. Our results from ablation model show the altitude range for different metallic ions and neutrals, which are compared with past studies.

Further, an interplanetary dust flux model is proposed for Venus, based on the available observations of interplanetary dust. A new velocity distribution model is presented from Galileo dust observations, covering heliocentric distance of Venus. Taking the proposed flux as an input in our ablation model, we find production rate for different ion and neutral species, produced by the dust. A parameter called Mass Ablation Ratio is defined and its results are presented for Mars and Venus. The proposed flux model of dust at Venus can be useful as an input to ablation model and also, to prepare for data analyses of upcoming space missions for Venus.

Source/Reference of the Work: https://doi.org/10.1016/j.pss.2022.105617

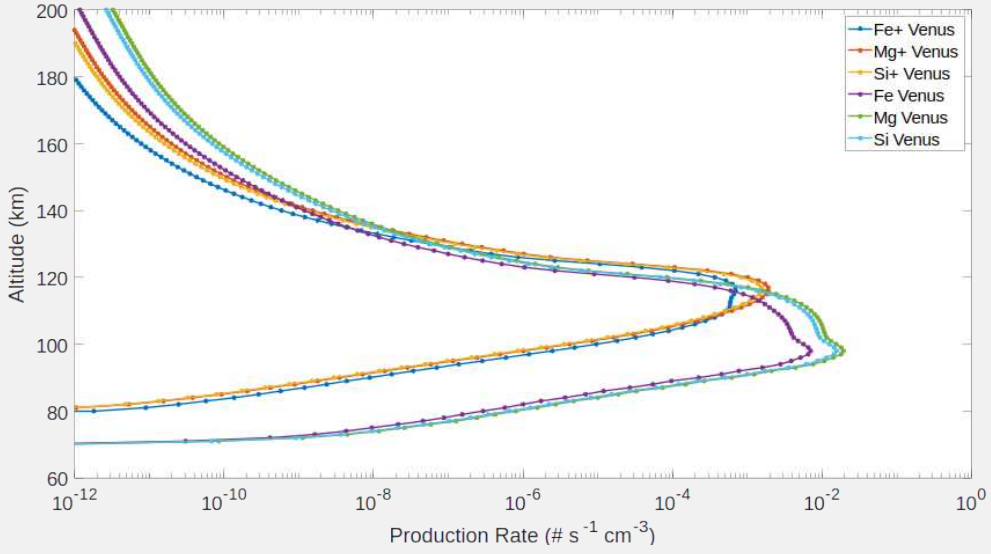


Figure Caption: Profile of Fe^+, Mg^+, Si^+, Fe, Mg and Si in the Venusian atmosphere due to ablation of incoming dust with particles mass from 10^{-18} to 10^{2} g. The peak altitudes of ~98 km and ~116 km are found for neutral and ions on Venus, respectively.

The Author

Satyajeet Patil

Anisotropic Spatial Entanglement

(***Satyajeet Patil***, *Shashi Prabhakar, Ayan Biswas, Ashok Kumar, and R. P. Singh)*

The Nobel prize in physics 2022 was awarded jointly to A. Aspect, J. Clauser and A. Zeilinger, for their remarkable contribution to the field of quantum. J. Clauser was the first one to demonstrate the violation of Bell's inequality experimentally. Later, A. Aspect conducted groundbreaking experiments using entangled photons that closed an important loophole from J. Clauser's experiment. Using refined tools and long series of experiments, Anton Zeilinger and his research group have demonstrated a phenomenon called quantum teleportation, which makes it possible to move a quantum state from one particle to one at a distance. These and other experiments confirm the predictions of quantum mechanics and pave the way for quantum computers, quantum networks, and quantum encrypted communication. Quantum entanglement could exist in several degrees of freedom, such as polarization, position-momentum, spatial modes, etc. The position-momentum entanglement is known as spatial entanglement, and it lies at the heart of several fundamental and applied aspects of quantum information and quantum technology. On the one hand, it is a direct implication of the Einstein-Podolsky-Rosen paradox; on the other hand, it allows access to the higher dimensional space for quantum technological applications. One of the most common systems used to demonstrate spatial entanglement is based on spontaneous parametric down-conversion.

The photon pairs generated through spontaneous parametric down-conversion (SPDC) possess strong correlations in their transverse position and momentum degrees of freedom. For such photon pairs, the transverse position correlation length depends on the crystal thickness and the pump wavelength. In contrast, the transverse momentum correlation length depends on the pump's beam waist and spatial coherence length. By controlling these parameters, it is possible to engineer spatial entanglement. Here, we utilize the circular asymmetry of the pump by using an elliptical-Gaussian beam to change the degree of entanglement in transverse directions, which we call anisotropic entanglement. We show the interrelation between the degree of anisotropic entanglement and the asymmetry in the beam width. In addition, we also show that for a highly asymmetric pump beam, the entanglement vanishes along the direction of the thinner beam width. In comparison, it remains intact in the direction of the broader beam width.

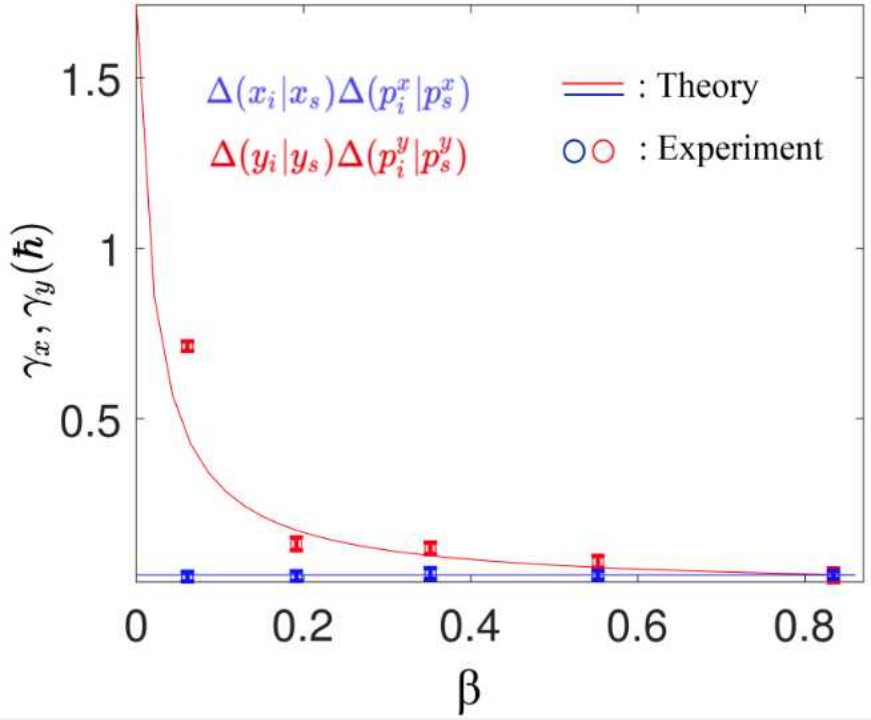


Figure Caption: The variation of γ_x (blue circle) and γ_y (red circle) against the asymmetry factor β. Continuous traces, blue and red correspond to the theoretical interpretation of γ_x and γ_y with β, respectively. γ_x, and γ_y, are the entanglement along the x and y directions.

Source/Reference of the Work: https://doi.org/10.1016/j.physleta.2022.128583

The Author

K. Durga Prasad

First Comprehensive 3D Thermophysical Model of the Moon

(***K. Durga Prasad***)

Surface and subsurface temperatures of the Moon are dictated by a complex interplay of several dependent parameters and therefore exhibit a significant variation both at local and regional scales. Knowledge of these temperature variations and thermophysical characteristics of the Moon is an important aspect for its scientific understanding (geophysical characterisation and thermal evolution). Such an information is also essential for planning future in-situ experiments, resource utilisation and even human exploration of the Moon. We have built a comprehensive three-dimensional thermophysical model for the Moon to derive its surface and sub-surface temperatures. A unique feature of this model is its ability to account for lateral heat transport in three dimensions by utilising the actual topography of any location on the Moon to compute its realistic surface and subsurface temperatures at any scale (from few cms to several kms.) Such a model is not available till date. The model considers all plausible conditions and parameters to derive the temperatures and thermophysical parameters of the lunar surface and subsurface to represent the most realistic scenario. The model results compare well with laboratory experiments and validated using Apollo in situ measurements. The capability of the model is demonstrated by deriving the thermophysical behaviour of a small area of Apollo 17 landing site at both regional and local scales. This work has several applications both for lunar science and exploration aspects. To list a few, it can be used to constrain the nature of the outermost porous/dust layer. Knowledge of the nature of this surficial layer on a global scale combined with model calculations of the subsurface heat propagation can help in estimating the subsurface boundary showing the influence of solar insolation. This is an important input for planning the depth of deployment of heat flow probes of future geophysical experiments on the Moon. This information can also effectively be used apriori in determining the lunar heat flow values based on remote observations and theoretical modeling. The unique ability of the model to import any complex topography facilitates the derivation of thermophysical behavior for any site of interest on the Moon to understand its local thermophysics that has significant implications on polar water-ice prospecting studies and in situ resource utilisation. Further, in combination with laboratory measurements, the model will help to interpret data returned from future in-situ experiments, such as ChaSTE experiment of Chandrayaan-3. This model will also help understanding the local thermal environment of any location on the Moon which is an essential aspect for future human exploration and lunar habitat. Importantly, this work gains significance in view of the recent renewed interest in lunar exploration and planned attempts to send humans back to the Moon.

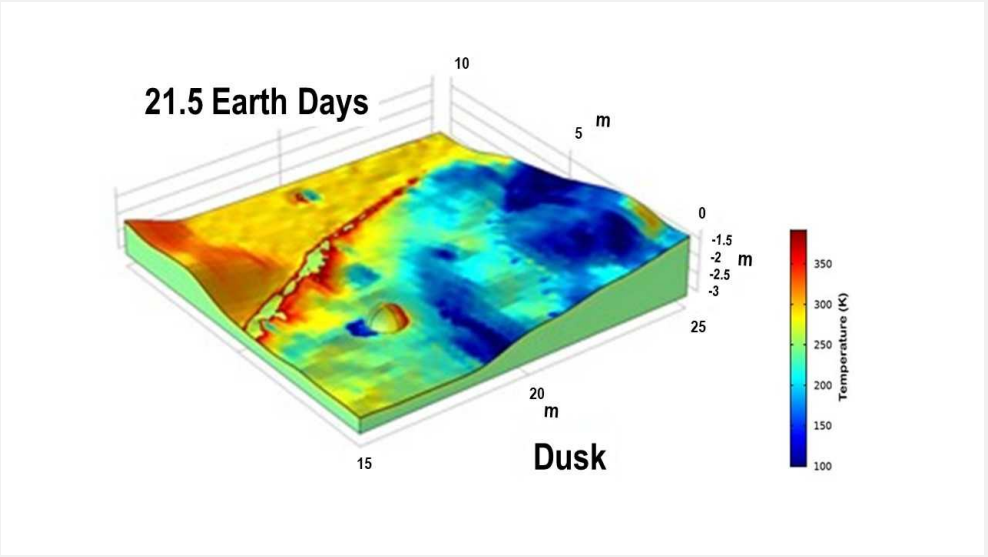


Figure Caption: Image showing the model derived surface temperatures for a small 100 sqm. area of Apollo 17 landing site, during dusk time. A contrast temperature variation (ΔT = ~300K) within the given area as predicted by the model shows its unique capability which was not available till date.

Source/Reference of the Work: https://doi.org/10.1029/2021EA001968

The Author

Kamran Ansari

Radiative effects of absorbing aerosol types over South Asia

(***Kamran Ansari***, *S. Ramachandran)*

Atmospheric aerosols contribute the largest uncertainty to the total radiative forcing of climate. One of the major contributing parameters to uncertainty in aerosol radiative forcing (ARF) is uncertainty associated with aerosol absorption due to lack of its accurate measurements and characterization. An accurate classification of absorbing aerosols, and quantifying their associated contributions to ARF are essential for understanding the aerosol radiative effects and improving the accuracy in ARF estimation over a highly polluted region like South Asia. A comprehensive study on the classification of absorbing aerosol types (Mostly Black Carbon (MBC), Mostly Dust (MD), and Mixed (BC+Dust)), and quantification of the effect of absorbing aerosol types on aerosol optical, physical, and radiative properties using high-quality Aerosol Robotic Network (AERONET) datasets over 9 observation sites in South Asia is conducted. MBC and Mixed types are present throughout the year over South Asia. MD type is absent over Pokhara (Himalayas), Bhola, and Dhaka (Bangladesh). On a regional-scale over South Asia, the annual mean aerosol optical depth (AOD) for MBC is higher over the central and eastern Indo-Gangetic Plain (IGP) sites. AOD for MD is higher over the western IGP sites. Ångström exponent (AE) for MBC is higher due to the dominance of fine mode aerosols. MBC-induced atmospheric ARF and ARF efficiency, and heating rate are higher than Mixed and MD types over South Asia due to higher AOD and lower single scattering albedo (SSA) (higher absorption) of MBC type. The quantification of the impact of absorbing aerosol types on aerosol radiative properties over a global aerosol hotspot can be useful as inputs for aerosol retrievals from satellites and to fine-tune the models for an accurate assessment of radiative and climatic impacts of aerosols.

Source/Reference of the Work: https://doi.org/10.1016/j.scitotenv.2022.159969

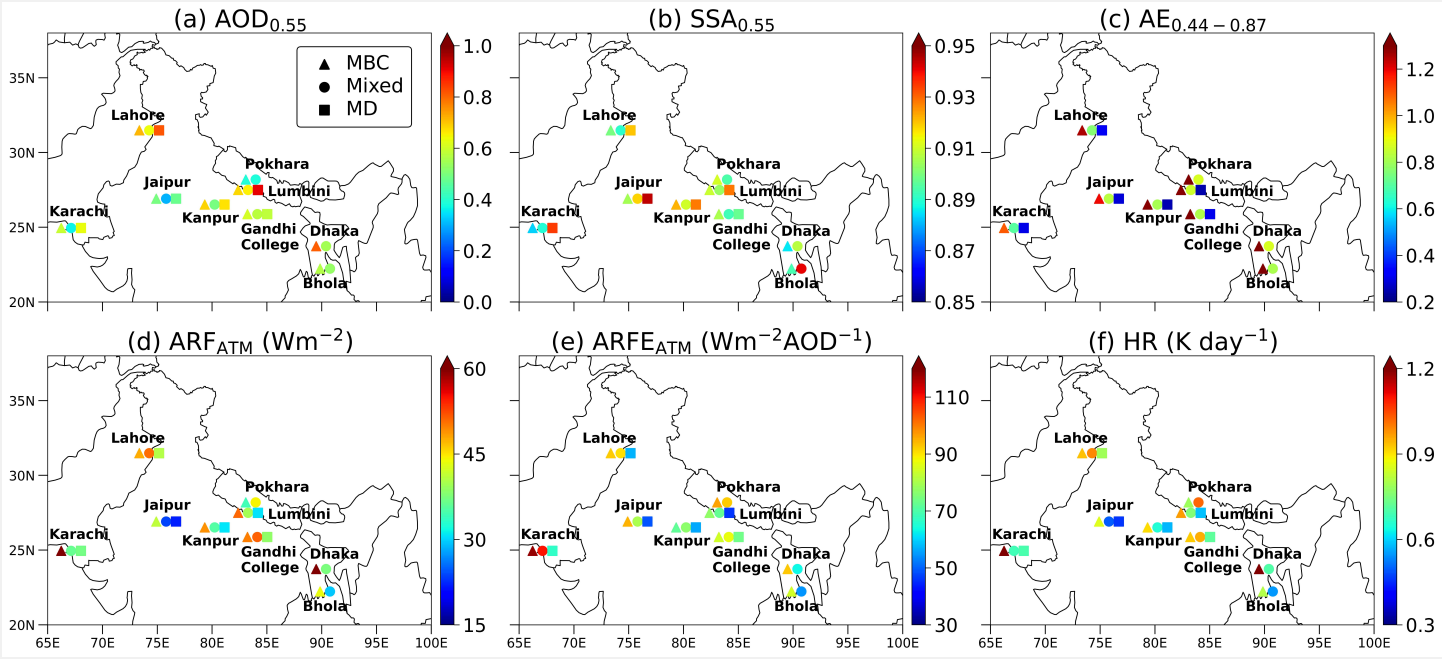


Figure Caption: The regional distribution of annual mean (a) aerosol optical depth (AOD), (b) single scattering albedo (SSA), (c) Ångström exponent (AE), (d) aerosol radiative forcing in atmosphere (ARF_{ATM}), (e) ARF efficiency in atmosphere ($ARFE_{ATM}$), and (f) heating rate (HR) for absorbing aerosol types (mostly BC (MBC): ▲, Mixed (BC+dust): ●, and mostly dust (MD): ■) over the South Asian region.

The Author

Yogesh Kumar Maurya

Magnetic reconnections as the underlying cause of spontaneous generation and annihilation of three-dimensional magnetic nulls

(***Yogesh Kumar Maurya***, *Ramit Bhattacharyya, and David I. Pontin)*

Three-dimensional (3D) magnetic nulls are preferential sites for triggering solar coronal transients. Although these nulls are abundant in the solar atmosphere, their generation is yet to be thoroughly explored. This paper explores the mechanism of null generation as well as annihilation in detail by means of implicit large eddy simulations where magnetohydrodynamic equations are solved in the absence of an explicit magnetic diffusivity. The magnetofluid is idealized to be thermodynamically inactive, incompressible, and have perfect explicit electrical conductivity. The simulated dynamics is initiated by a prescribed flow in a magnetic configuration having an isolated current-free 3D null. The flow facilitates reconnections, which lead to the generation of primary null pairs in a way that preserves the topological degree. The formation process of these null pairs is novel and different from the standard pitchfork bifurcation. Contrarily, here we found creation of null pairs away from the central null, which we hypothesize is due to the interaction of the imposed flow and the reconnection outflow from the central current layer. Intriguingly, further evolution spontaneously generates new null pairs, which have a novelty by itself. As theorized, these spontaneously generated null pairs also preserve the net topological degree—adding credibility to the simulation. The simulation also shows null pair annihilation. Magnetic reconnections are identified to be responsible for the generation and annihilation of the nulls—opening up the possibility for the nulls to be self-organized structures. Furthermore, the reconnection being ubiquitous in the corona, it can explain the coronal abundance of magnetic nulls.

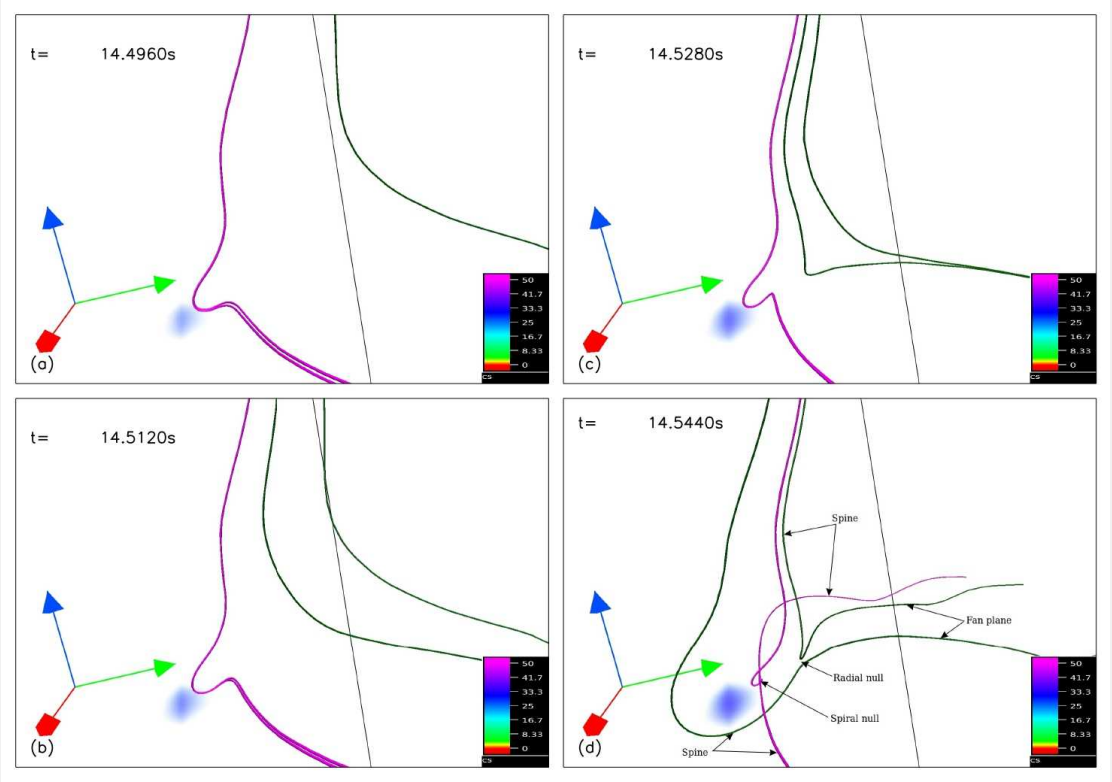


Figure Caption: The snapshots of the figure illustrate the magnetic reconnection in null generation. The magnetic field lines develop the elbow shape which is clearly visible in panels (a) and (b), and becomes most prominent in panel (c). Furthermore, across panels (c) and (d), one of the two green field lines changes its connectivity by moving from right to the left of the elbow. Such changes in the connectivity of a single field line are magnetic reconnection. Topological features, such as the radial and spiral nulls along with their spine, and fan plane of the radial null are marked by arrows in panel (d). Similarly, the pink field lines also change their connectivity through magnetic reconnection. Hence, magnetic reconnections are underlying cause of generation of nulls.

Source/Reference of the Work: https://doi.org/10.1063/5.0107601

The Author

Shubhra Sharma

Mountain highway stability threading on the fragile terrain of upper Ganga catchment (Uttarakhand Himalaya), India

*(Sati S.P., **Sharma S.**, Kothyari G.C., Asim M., Sundriyal Y.P., Malik K., Joshi A., Dobhal H., Rana N. and Juyal N.)*

In recent times, to cater for the need of the fast-growing population in the Indian Himalaya Region (IHR), there is a significant increase in road construction including widening in the seismically active and monsoon-dominated upper Ganga catchment (Uttarakhand Himalaya). The success of Himalayan Roads lies in the early assessment of the risk posed by potential geohazards particularly, the slope instability caused due to the excavation of steep slopes. However, the inherent geological, geomorphological, ecological, and climate fragility of the terrain warrants critical scientific intervention for the roads to sustain the vagaries of nature. We investigated a few representative road segments in the upper Ganga catchment (Uttarakhand Himalaya) which are currently undergoing widening. Detailed field observations supported by remote sensing data indicate that prior to the major road widening project (pre-2018) the landslides occupied around 51×10^3 m^2 area which increased to 350×10^3 m^2 following the road widening in 2022. The increase in landslide area is attributed to the poor slope management along the geologically and structurally weak segment. The Persistent Scatterer Interferometric Synthetic Aperture Radar (PSInSAR) data indicate that the segments where maximum slope instability is observed are undergoing a high rate of surface deformation. The study, therefore, suggests that disaster-resilient roads in the Himalayas must account for the geological fragility with an emphasis on slope stability and its management.

Source/Reference of the Work: https://doi.org/10.1007/s11629-022-7496-1

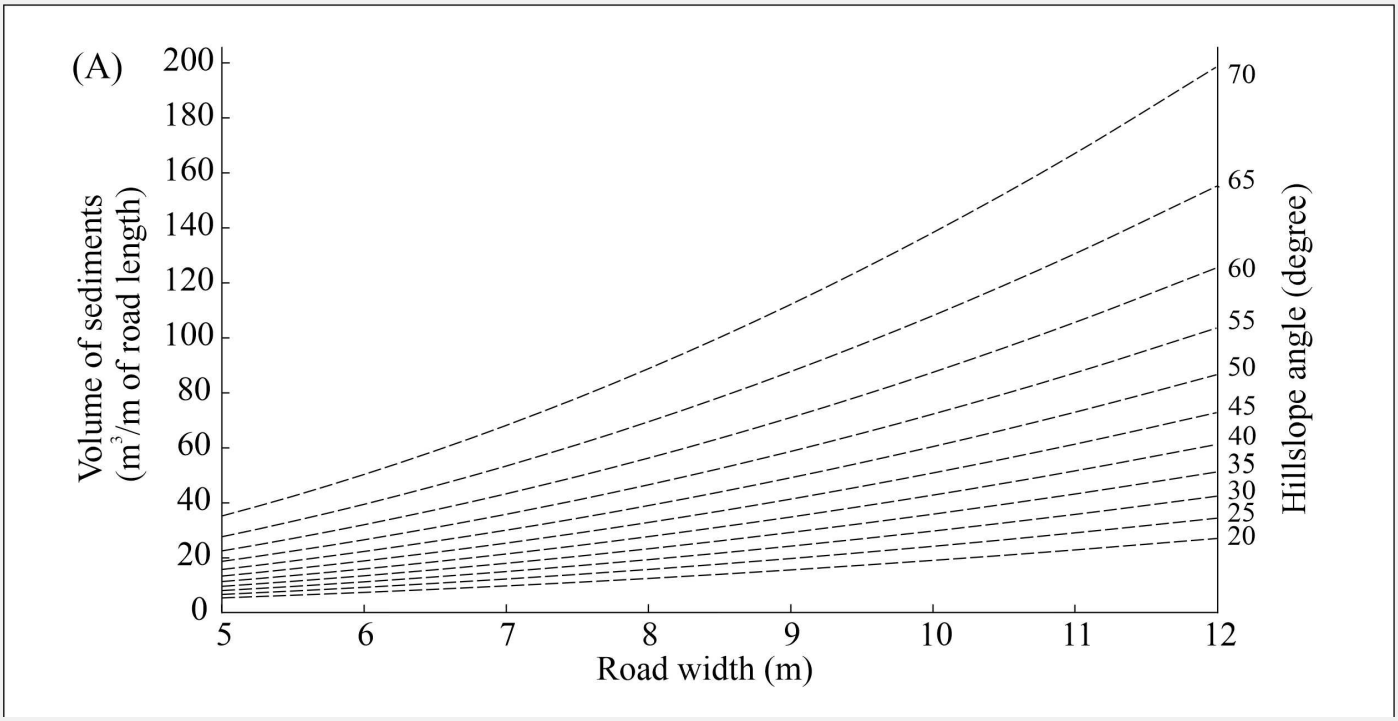


Figure Caption: Optimal road width must account for the exponential increase in the volume of sediment generated on steeper and wider roads for sustainable roads.

The Author

K. Aravind

Optical observations and dust modelling of comet 156P/Russell-LINEAR

(***K.Aravind***, *Prithish Halder, Shashikiran Ganesh, Devendra Sahu, Miquel Serra-Ricart, José J. Chambó , Dorje Angchuk , Thirupathi Sivarani)*

Comet 156P/Russell-LINEAR is a short period Jupiter family comet with an orbital period of 6.44 years. This comet has never been studied in detail due to its unfavourable apparitions. We analysed the comet with spectroscopic, photometric and polarimetric observations from the two Indian observatories, 1.2 m Mt. Abu and 2 m HCT, Hanle. Along with this, dust modelling studies were also performed to understand the physio-compositional properties of the comet. From the spectroscopic study, strong emissions from CN (Δν=0), C3 (λ4050 Å), C2 (Δν=+1), and C2 (Δν=0) were observed during both the epochs of our observations. The production rate ratio, Q(C2)/Q(CN), classifies the comet as a typical comet. The imaging data revealed the presence of strong jets. The dust emission from the comet was observed to have a non-steady state outflow due to the presence of these strong jets which subside in later epochs. Polarimetric study at two different phase angles revealed the degree of polarization to be comparable to Jupiter family comets at similar phase angles. Localized variations in polarization values were seen within the coma. The dust modelling studies suggest the presence of high amount of silicate/low absorbing material and indicate the coma to be dominated by higher amount of large size grains with low porosity having power law size distribution index = 2.4. The observed activity and dust properties points to a similarity to another Jupiter family comet, 67P/ Churyumov–Gerasimenko.

Source/Reference of the Work: https://doi.org/10.1016/j.icarus.2022.115042

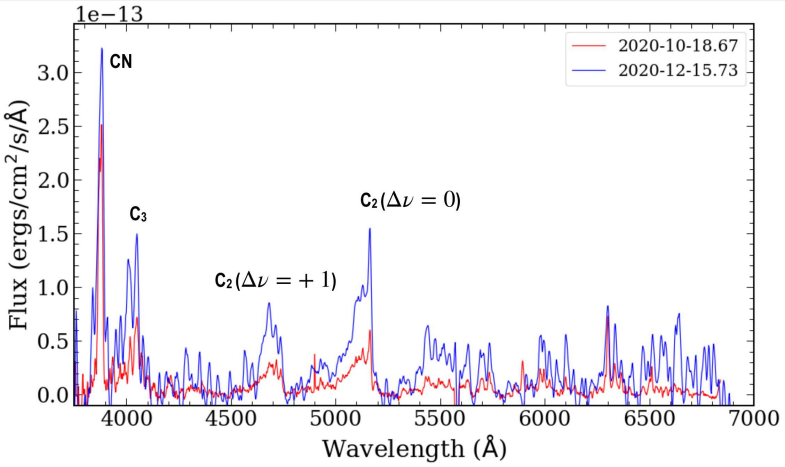


Figure Caption: Red: Optical spectrum of 156P observed pre-perihelion with the HFOSC instrument on HCT on 2020-10-18.67 UT; Blue: Optical spectrum of 156P post-perihelion observed with the LISA instrument on MIRO on 2020-12-15.73 UT.

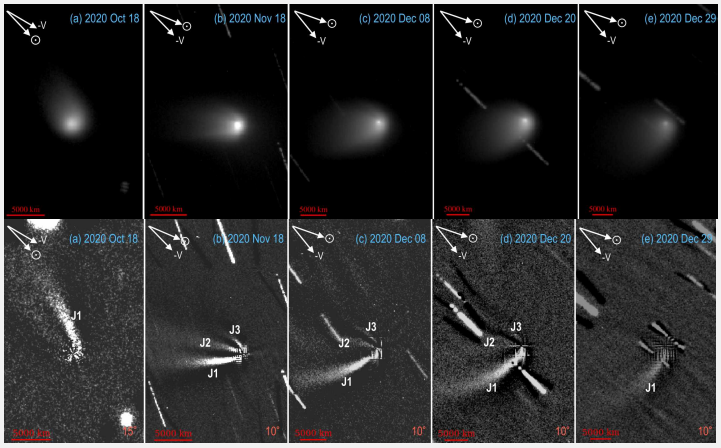
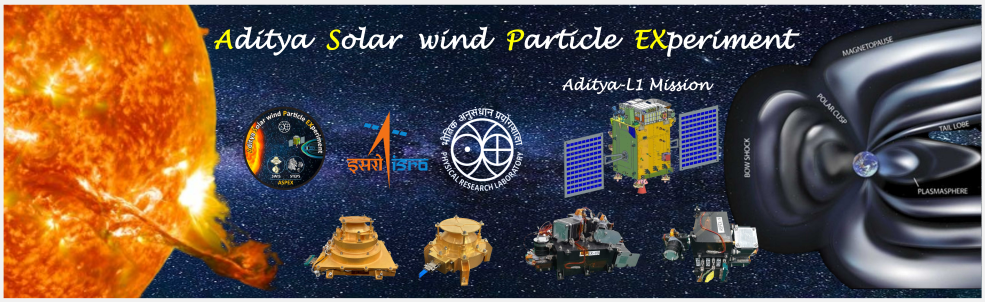


Figure Caption: Compilation of few of the reduced imaging data of comet 156P (Top panel) and the corresponding LS processed images (Bottom panel) illustrating the different strong dust jets (J1, J2, J3) observed in the comet.



Solar-wind Ion Spectrometer (SWIS) Flag Off

The Physical Research Laboratory (PRL) witnessed an exciting event on December 19, 2023, in the form of SWIS payload flag-off to URSC, Bangalore in the presence of around 150 people, including scientists and engineers from PRL and SAC, as well as some distinguished invitees.

The flag-off ceremony was held at the PRL Thaltej Campus and was led by Prof. Anil Bhardwaj, who officially flagged-off SWIS sub-system of ASPEX payload. During the event, posters were displayed that provided details on the ADITYA-L1 mission and ASPEX payload, and a video was shown that showcased different stages of development for the SWIS (and STEPS) subsystem of ASPEX payload. Note, STEPS subsystem of the ASPEX payload was flagged-off earlier.

The flag-off of the SWIS, was a historic moment for PRL and a testament to the dedication and hard work of the scientists and engineers involved for the past many years. The event was a celebration of the mission's progress and an exciting start to the next phase of the journey. We will be eagerly looking forward to the data that ASPEX will send from the orbit.

CSSTEAP Short Course on Space Weather

A short course on "Space Weather" was conducted during December 20-30, 2022 by Physical Research Laboratory (PRL), Ahmedabad under the auspices of Center for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), affiliated to the United Nations.
The inaugural ceremony was held at PRL on 20th December. There were 21 participants from 11 countries (Bangladesh, Ethiopia, India, Kazakhstan, Kyrgyzstan, Mongolia, Myanmar, Nepal, Sri Lanka, Tajikistan and Uzbekistan). Classes were held at Nano-SIMS hall. A total of 25 lectures were delivered by PRL's expert faculty on:

- Solar sources of space weather
- Propagation of the electromagnetic and charged particles through the heliosphere
- The response of Earth's magnetosphere, ionosphere and thermosphere to Space Weather
- Solar influence on middle atmospheric processes
- Effect of Space Weather on electronic and communications systems

For a better understanding of the theory, there were practical sessions on:

1. Measurement of the speed of coronal mass ejection
2. Measurements of sunspots
3. Measurement of the geomagnetic field
4. Radio sounding of the ionosphere
5. Measurements of TEC and scintillation using GPS
6. Study of optical signatures of space weather events.

As a part of the programme, the participants were taken to Udaipur Solar Observatory (USO) and Mount Abu Observatory for a very short scientific tour. The trip to USO started with a visit to MAST, the Multi-Application Solar Telescope installed on the island in Lake Fatehsagar. They also visited the GONG (Global Oscillation Network Group) and e-Callisto facilities in the main campus. At Mt Abu Observatory, the students observed Jupiter through the telescope.
Feedback from the participants was very positive.

Inaugural session of the CSSTEAP Short Course on Space Weather

Outreach @ USO: Visit of Students from R.N.T P.G. College, Kapasan, Chittorgarh

A group of students along with faculty members from R.N.T. P.G. College, Kapasan-312202, Chittorgarh visited Udaipur Solar Observatory on 24/01/2023. The group included students from B. Sc. and M. Sc. Physics background. The group visited Island Observatory, GONG and e-CALLISTO facilities of the Udaipur Solar Observatory. They were informed about different aspects of the Sun, solar activity and the multi-wavelength observations of the solar atmosphere.

Observance of Martyr's Day

As per the Government of India, Department of Space directives, every year 30th January is observed as Martyr's Day in memory of those who sacrificed their lives during struggle for India's freedom.
PRL members observed 2 (two) minutes of silence in memory of freedom fighters on Monday, the 30th January, 2023 at their respective work place.

Republic Day Celebration at PRL – 26 January 2023

The 74th Republic Day was celebrated on 26th January, 2023, at Physical Research Laboratory (PRL) Thaltej campus. Dr. Anil Bhardwaj, Director, PRL hoisted the National Flag followed by the National Anthem. In his address to PRL family, the Director briefed about the various events, activities, achievements, honours etc. acquired by PRL during the year.

Three merit awards were given to the Central Industrial Security Force (CISF) personnel. Service Awards to PRL staff members who have completed 25 years of services in PRL were also presented.

This was followed by presentation of the Awards to:
(a) The children of PRL staff who secured Highest marks in Hindi subject in 10th and 12th standard during the year 2022. (b) Space Official Language Implementation Scheme (SOLIS) related prizes (c) Hindi Speech Competition (Vishwa Hindi Diwas) and (d) Quiz competition held during Vigilance Awareness Week 2022.

Tree-plantation was done by the newly joined PRL Staff Members, Awardees, would-be-retirees of the year and other PRL members at open ground of the Campus.

As a symbol of freedom & growth of our Country & Institute to sky heights, Tri-color balloons were released on this occasion. Kids enjoyed this event at optimum.

Treasure Hunt Competition at USO / PRL, Udaipur

On the occasion of 74th Republic Day, a treasure hunt competition was organized for all the permanent employees & their family members, research scholars, PDFs and trainees at USO/PRL, Udaipur under the Azadi ka Amrit Mahotsav.

Under this program all the participants were divided into various groups (teams). In order to maintain balance in the selection of teams, equal number of staff members & family members, research scholars / PDFs and trainees were placed in each team so that all team members have equal participation in understanding and recognizing technical and common clues. Different clues were given to each team.

Each clue was interconnected in such a way that solving the first clue could lead to the second clue. Along with each clue, some souvenirs were kept by which their curiosity can be maintained. After finding all the clues, each team had to reach the canteen. The first three teams to reach the canteen after finding all the clues were declared as the first, second and third winners respectively according to the time taken by them.

Treasure Hunt Competition organized by C-AKAM at PRL

On the occasion of the 74th Republic day and in continuation to the celebrations under Azadi Ka Amrit Mahotsav (AKAM), a Treasure Hunt event was organized at PRL Thaltej Campus on 26/01/2023. This event was devised with the idea to make all participants aware of various facilities, labs, nooks, and corners of the Thaltej Campus of PRL. In total 105 participants including permanent staff, research scholars, project associates, post-doctoral fellows, Trainees, and their family members – parents/spouses/kids (kids of age 10 years and above) took part in the event.

The participants were divided into 20 teams and provided with links to clues managed through a google form. Each team was given out a unique trail covering the entire campus. The clues were thoughtfully assigned unique ids with the names of constellations and famous Indian Scientists. Each team was required to reach their designated locations and upload a selfie of the group at that location. Once uploaded, the team got the next clue using the google form. The teams who could complete the hunt correctly in minimum time were the winners. This event turned out to be a grand success with the help of committed volunteers.

Winners of the event are:

1. **Team #8**: Nirbhay Upadhyay, Joona, Sunil Kumar, Shubhendra N. Das, Karman Singh, Vikhyat Upadhyay
2. **Team #20**: Sana Ahmed, Dibyendu Mishra, Ankit, Sona Panchal, Utsav Sharma
3. **Team #16**: Anil Kumar Yadav, Sashikant, Pina Kori, Shivani Baliyan, Smita Shah, Akshaya Prerna

Organizing Team, C-AKAM

Organizing Team led by Dr. Nishtha Anilkumar and members:
Sh. Vaibhav Dixit , Sh. Vishal M Shah, Ms. Priti K Poddar, Dr. Vishal Joshi, Sh. Jaya Krishna Meka, Sh. Srirag Narayanan Nambiar, Dr. Pragya Pandey, Sh. Neelam J S S V Prasad, Ms. Sonam Jitarwal, Sh. Vishnubhai R Patel , Sh. Bhatia Vishweshraj, Dr. Md Nurul Alam, Ms. Nandini R Rao, Ms. Jayshree Balan Iyer, Ms. Harsha Parmar
Dr. Lokesh Sahu, Sh.Pradeep Kumar Sharma, Sh. Atul Ashok Manke

Glimpses from the Event

Book Exhibition at Thaltej Campus

The Library organized a book exhibition as a part of the AKAM activity at the Old Building Foyer, Thaltej Campus on 26-27 January 2023.

There were around 600 scientific, general, and Hindi books on display by three booksellers. The in-campus exhibition helps the staff to browse through many books in their area of interest which are a useful addition to the library collection. The exhibition attracted active participation from research scholars, staff, and faculty members of PRL. There were 194 books recommended by them for the library and 4 books for personal use. The event was well received by research scholars, staff, and faculty members of PRL.

Glimpses from the Event

A one day meet on “PRL’s 75 years science journey and our role” by PRL Alumni

A growth of an institution is best evaluated by the career-path of its alumni. PRL has produced ~500 alumni in last 75 years and many of these have reached to serve at the top level of different institutions in India and worldwide. Ongoing platinum jubilee celebrations gave an occasion to reflect our legacy and the contributions we have made to science.

Inauguration of this one-day conference, held on the 30th of January, 2023, was started with the welcome address by our patron, Prof. Anil Bhardwaj, Director, PRL; followed by a historical perspective given by Prof. Sunil Kumar Singh, President, PRL Alumni Association. The occasion was graced by PRL’s one of the most illustrious alumni Prof. K. Kasturirangan, who inspired each one of us by talking about "My Professional Forays- People, Challenges & Anecdotes”. There were four talks by relatively young PRL alumni, who shared their exciting science. There was a fruitful and informative panel discussion on “Science in transition – fundamental science to citizen science” moderated by Prof. R. Bhutani in which Profs. Sunil Singh, JS Ray, D. Pallamraju, A. Tej, and E. Krishnakumar shared their thoughts. The meeting was attended by almost 100 PRL alumni and some of their family members also joined.

My journey to the Hot Seat: Kaun Banega Crorepati 2022

The Author

Sneha Nair

Twenty-two years ago when Kaun Banega Crorepati was aired for the first time, it revolutionized the way people watched television. This Iconic Show, modelled on the UK game show “Who Wants To Be A Millionaire”, kept the viewers hooked to the television for an hour every day. Those were the days when internet wasn’t fast enough to find the answers, and judging contestants from your living room was a daily activity. You would scream out the answer before the contestants could. KBC became a household name in India. I remember the phrases “Let’s play Kaun Banega Crorepati”, “Lock kiya jaaye”, “Computerji/Gyannathji”, in Big B’s popular strong baritone. It will make you instantly think about the OG angry young man of Bollywood, Mr. Amitabh Bachchan. I can recall those times from my childhood memories. Me and my family were no different! Except for the fact that my mom was and is the biggest fan of Mr. Bachchan. Like every other family, we would all finish our chores and get hooked to the T.V at 9:00 pm. It was more like a daily family ritual topped up with mom’s fandom for Mr. Bachchan. It was this fandom that inspired me to participate in the show so that my mother could fulfil her dream of meeting Mr. Bachchan. This is where my actual journey of KBC had begun.

My first step of entering into KBC was, when the registrations for KBC began in the first week of April 2022. This was my very first attempt at this show. It all started with simple GK questions which were asked each day which could be answered via Sony LIV App or SMS. You register with your details in the SonyLIV app, answer the Question of the Day till the registration is open and keep your fingers crossed for the randomiser to select you for the next round. So, I just picked my phone and took my first step towards becoming a millionaire! On being selected to the next round, the automated responsor quickly threw three questions which had to be answered within a few seconds. Basically, no time to plan a peek-a-boo! You know it or you don't.

I was fortunate to have been shortlisted for the Ground Auditions at Vadodara (out of 2.5 Crore registrations, 8000 participants were selected and I was one of those 0.00032% !). The ground audition consisted of two parts: first, a quiz in a MCQ format and the questions were extremely general: current affairs, history, geography, science, cinema, sports, arts and culture, etc, basically everything under the sun! Second part was the Personal Interview round where I was further shortlisted to be among the top 4000 candidates.

I have always been a curious kid and had keen interest in general knowledge. I have participated in various quiz competitions in my childhood like: the Bournvita Quiz Contest, TERI, Quiz programme by United Nations, and many more. While preparing for the auditions, I realized it is not about that one book or about 15 days/1-month preparation that you will read and crack the show, instead it is about what all you have learnt through your life.

After the Ground auditions, there was no further communication from the KBC team. In fact, the show had started airing and I was convinced that I hadn’t

Ground Audition at Vadodara, Gujarat.

made it. Thus, I completely forgot about it. And then, in the last week of August I received the magical call for making it to the Fastest Finger First round. The image of Amitabh Bachchan walking down the stage, the giant KBC logo halo-ing him, and the iconic theme tune started playing in my mind.

Wide eyed and awestruck, we reached the HIGH-TECH set of Kaun Banega Crorepati in Mumbai. There were LED and laser lights at every corner, drone cameras, computer controlled lights and the whole set looked so futuristic. I was already feeling like a celebrity. Being in the Film City is a privilege in itself as you get a glimpse of the seemingly perfect world of cinema. The entire logistics was very well taken care of by the KBC productions. Kudos to the highly enthusiastic and energetic crew of KBC.

Amitabh Bachchan greets audiences with his hallmark line – "Deviyon Aur Sajjano".. and I knew the rest of the lines. He is also known as AB on the sets. I was awestruck by his magnificence and humbled by his humility. It is very difficult for me to describe in words because I have seen all the people of my generation and before me who have idolized Mr Bachchan. I have grown up watching all his movies. The 80s and 90s kids might remember him as the megastar Amitabh Bachchan for his iconic screen characters. There are movies of him that I have watched more than ten times. Even today while switching the TV channels, if I come across a movie like Abhimaan, Sholay, Chupke chupke, Don, I watch it all over again. And to see him in person or in front of you was a dream come true. It takes a while to sink in that you are in front of him. However, only a few fortunate ones get to live that moment. Having said that, my favourite part of being on the show was to see the look of pride in my mother's eyes.

The quintessential photo with my mother and Mr. Amitabh Bachchan.

The fastest finger first and the actual questions are all asked in real time and are shot exactly in the same time frame as it is shown on TV. It was not a cake walk for me to reach the Hot Seat. It took 3 days and multiple fastest finger first rounds before I made it to the coveted Hot Seat. It felt like climbing a mountain and as they say "The best view comes after the hardest climb"! An incredible sense of accomplishment.

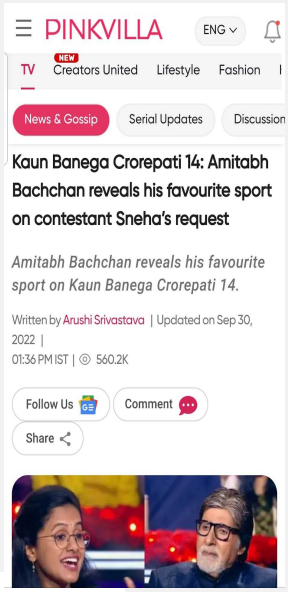
"Being on the Hot Seat on India's most popular, longest running knowledge based show, was an exciting and unforgettable experience."

Being on the Hot Seat on India's most popular, longest running knowledge based show, was an exciting and unforgettable experience. During my interaction with AB Sir on the show, I represented PRL, talked about ISRO, Dept. Of Space and its activities. As India marked 75 years of its independence, it was a great opportunity for me to remember, honour and celebrate the memory of Dr. Vikram Sarabhai and his immense contributions to our nation. I spoke about Dr. Vikram Sarabhai and Dr. Homi Bhabha who were not just great scientists but also the greatest visionaries that this country has ever produced. I also, talked about Indian Classical Dance form Bharatnatyam, Tennikoit, and Ball Badminton. AB Sir was quite impressed with my proficiency in Hindi. Once I started playing the game, it was smooth sailing till the Pehla Padhav. Subsequently, I used my lifelines to reach the Dusra Padhav and was very happy to receive "Gowardhan Ghee Saal bhar ka Bhandaar"!

To my surprise, I was approached by the Secretary General of Tennikoit Association for

playing Nationals tournament. I received appreciation through emails, messages, etc starting from a TedX Speaker from USA, to retired faculties of PRL, and scientists from ISRO centres. Furthermore, Sony Entertainment Television created a hashtag for me and named me “Rocket Girl”! I am even called “HOTSEAT KI PRATIBHA”. Receiving a cheque signed by AB Sir was the icing on the cake.

All in all, it was an enriching experience that I will cherish throughout my life. I am grateful to have received so much recognition, respect, acknowledgement & appreciation throughout my journey and beyond. People of all age groups, from all across the globe; from young kids to professionals, they all have been following me, reaching out to me, taking selfies, shared my promo video on social media, published articles in newspapers, congratulating me through various mediums, all of this has been very



... “Sony Entertainment Television created a hashtag for me and named me “Rocket Girl”!”

overwhelming and I am full of gratitude. By inspiring kids and young ones to pursue knowledge as a means of achieving success, I think my purpose of being on the show has been served. Well, all I can say is that work hard, learn from your mistakes and make sure every day counts. And see where discipline takes you!

Last but not the least, I am really thankful and grateful to everyone who has been part of my journey. This achievement is dedicated to all those from my family, friends, PRL members to my earliest teachers who have believed, supported, encouraged and guided me to be the best version of myself.

PRL Ka Amrut Vyakhyaan

PKAV-76
Dr. K. Kasturirangan, Padma Vibhushan
Honorary Distinguished Advisor, ISRO, Former Chairman, ISRO & Secretary, Dept. Of Space, GoI
Member, Atomic Energy Commission, India, Former Member of Rajya Sabha and Planning Commission.

Vyakhyaan Title: My Professional Forays- People, Challenges & Anecdotes
Date: 30 January 2023.

PRL Monthly Publications Digest (January 2023)

Astronomy & Astrophysics Division [1]

1. S. Karmakar, Sachindra Naik, J. C. Pandey, I. S. Savanov, 2023, Swift and XMM-Newton observations of an RS CVn type eclipsing binary SZ Psc: Superflare and coronal properties, 2023, Monthly Notices of the Royal Astronomical Society, 518, 900-918, Date of Publication: 02/01/2023

Geosciences Division [2]

1. Shukla, G., Sudheer, A.K., Gunthe, S.S., Beig, G., Kumar, A., 2023, Seasonal Variability in Fine Particulate MatterWater Content and Estimated pH over a Coastal Region in the Northeast Arabian Sea, Atmosphere, Date of Publication: 28/01/2023

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1. Sumanjit Chakraborty and D. Chakrabarty, 2023, Global asymmetry in ΔX variations during the 06 April 2000 geomagnetic storm: Relative roles of IMF Bz and By, Journal of Geophysical Research: Space Physics, Date of Publication: 23/01/2023

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Awards & Honours

1.***Prof. D. Pallam Raju***, Senior Professor, Space and Atmospheric Sciences Division and Dean, PRL, has been elected as a ***Fellow of the Indian Academy of Sciences, Bangalore***.

2.***Prof. Srubabati Goswami***, Senior Professor, Theoretical Physics Division of PRL has been elected as ***Vice-President of Indian Physics Association for period 2023-2024***.

3.The project titled, ***"A comprehensive study of the physical and chemical evolution of volatiles and formation of organics in the comets: From reprocessing of primordial ices in cometary nuclei to the formation of cometary atmosphere during perihelion passage"*** proposed by ***Dr. Kinsuk Acharyya***, Associate Professor, Planetary Sciences Division of PRL, has been selected for support by ***Department of Science & Technology (DST) Core Research Grant***.

4.The project titled, "***Organics in meteorites: Understanding the parent body processes in the early solar system***" proposed by ***Dr. Kuljeet Kaur Marhas***, Professor, Planetary Sciences Division of PRL, has been recommended by ***Department of Science & Technology (DST) Core Research Grant*** to the ***Science and Engineering Research Board (SERB)*** for funding.

5.The project titled, "***Role of physical and chemical processes on the climate of Mars and Venus***" proposed by ***Dr. Varun Sheel***, Senior Professor and Head, Planetary Sciences Division of PRL, has been selected for support by the ***Science and Engineering Research Board (SERB)*** for ***Core Research Grant (CRG)*** for three years.

SUPERANNUATION

Name of the employee Mr. Vishal M. Shah

Designation at the time of superannuation Technical Officer-E

Date of Birth 06.01.1963

Date of Joining 17.05.1983

Date of superannuation 31.01.2023

Warm Farewell for the Retired Member!

OBITUARY

Late Shri M.S. Patel
Computer Scientist-SE

Date of Birth 09.02.1943

Date of Superannuation 28.02.2003

Date of Death 30.01.2023

Teary Eyes for the Departed Member

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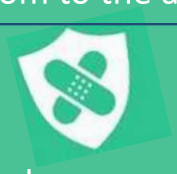
Cyber Security Awareness – Ransomware

Jigar Raval, Head, CNIT, PRL

Safeguard Ourselves from Ransomware

What is Ransomware?

It is a type of malware that locks the system/data access by encrypting the systems/data and threatens to keep it locked unless the victim pays a ransom to the attacker.



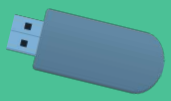
Always keep your Operating System (OS), Antivirus and Other Software Updated.

Never Click on Unknown or Advertisement Link.

Disable Macros in Office Applications.

Verify/Confirm the Name and Email Address of Email Sender. Do not open or reply to suspicious emails.

Never Download and Install application from unknown sources. Do not open any attachment received from unknown sources.



Regularly take backup of important files. Also, periodically verify recovery of files from backup.

Report Cyber Crime Incidents on - www.cybercrime.gov.in OR Call on - 1930