Newsletter of the Physical Research Laboratory

THE SPECTRUM

Image of the Month

Group photo of Indian Space Weather Conference 2 and Workshop

November 2023 Issue

Table of Contents

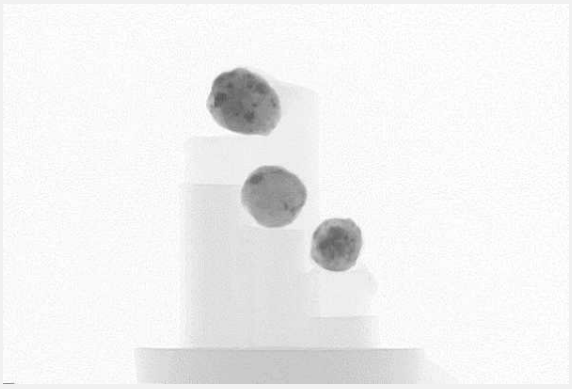
Physical properties and average atomic numbers of chondrules using computed tomography

(***Yogita Kadlag***, *David Haberthur, Ingo Leya, Ruslan Hlushchuk, Klaus Mezger*)

The Author

Yogita Kadlag

Micro/nano computed tomography is a quick and non-destructive technique to analyze 3D textural, physical, and chemical properties of solid objects with least or without any sample processing. In this study, we have explored the use of a micro-CT to obtain quantitative information of the physical properties and bulk atomic numbers of physically separated chondrules (Fig. 1) from primitive meteorites, i.e., unequilibrated ordinary, carbonaceous, and enstatite chondrites. Many chondrules show deviation from a spherical shape (Fig. 2, degree of deformation is deviation from spherical shape, A, B and C are three axes of ellipsoids) suggesting that they were affected by strain prior to solidification. The porosity of 44 chondrules ranges from 0.04 vol% to 5.3 vol%. Highest porosity and the largest voids are observed in the chondrules from carbonaceous chondrites. The high porosity could be caused by the presence of oxidized precursors in the chondrule melt that escaped as a gas during high temperature processing and crystallization of the melt. In some chondrules, pores are associated with opaque phases, suggesting their formation either during solidification of metal phases and/or during aqueous alteration. The average atomic numbers of chondrules range from 35 ± 4 to 22 ± 2, independently of porosity and opaque content and is likely controlled by the variation of Mg/Fe in chondrule silicates. The absence of a consistent variation between the degree of deformation, chondrule diameter (Fig. 2a), and porosity among the studied chondrules from different groups, suggests that the processes responsible for the different physical properties of the chondrules are decoupled from each other and are likely universal to all chondrules.



Source/Reference of the Work: https://doi.org/10.1016/j.pss.2023.105799

Figure 1: Separated chondrules on the micro-CT holder

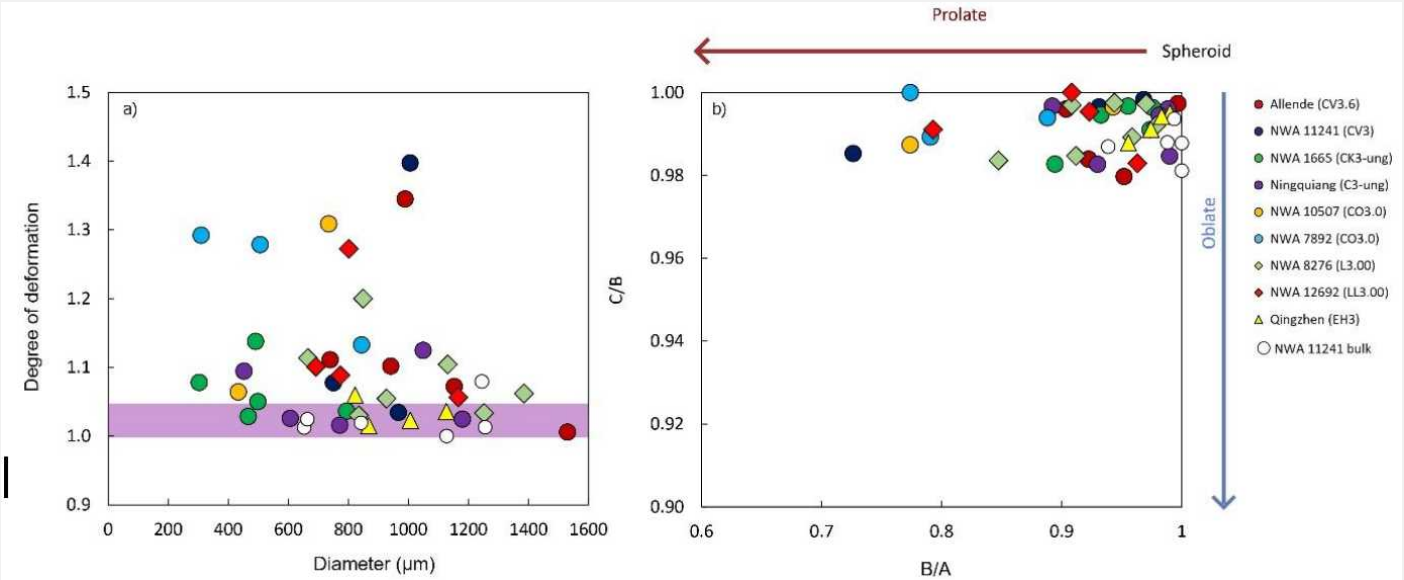


Figure 2: a) Degree of deformation (DD) vs diameter of chondrules, b) C/B vs B/A values of chondrules suggests many chondrules are prolate.

The Author

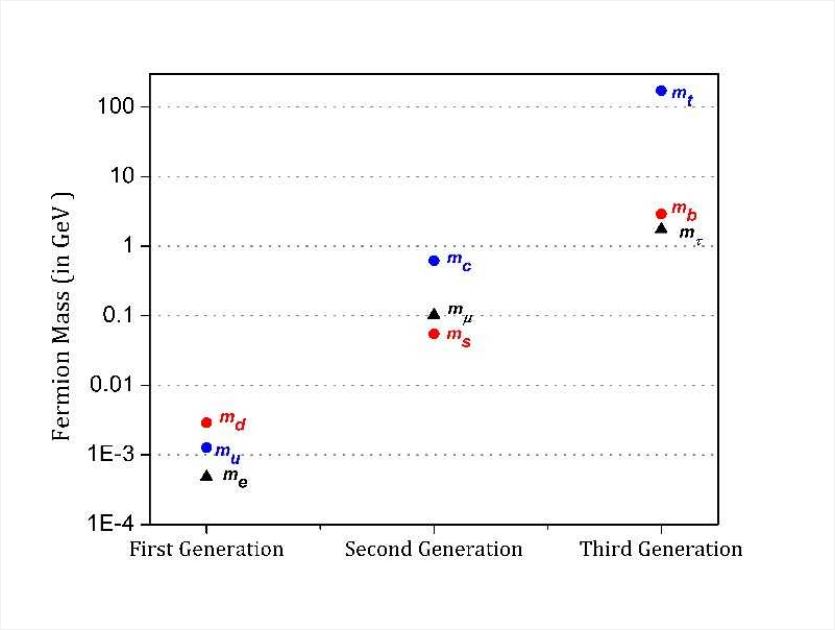
Gurucharan Mohanta

Fermion mass hierarchy through quantum corrections

(***Gurucharan Mohanta***, *Ketan M. Patel*)

The fundamental forces of nature are mediated by gauge bosons. These gauge bosons are associated with symmetries called gauge symmetries. The well-known gauge boson so-called photon (A) is the field quanta of the gauge field associated with $U(1)$ electromagnetic symmetry. There are also $W^{\pm}$ and Z bosons which mediate weak interactions. These A, $W^{\pm}$, and Z gauge bosons combinedly come from spontaneous symmetry breaking of $SU(2)_L \times U(1)_Y$ non-abelian theory, which is called the theory of electroweak interactions. Combined with $SU(3)$ color symmetry (responsible for strong interactions), the theory is called the Standard Model (SM) of Particle physics. This is the widely accepted theory of fundamental particles, which describes almost all of the phenomena of our visible nature and is also experimentally well-verified. However, there is a major theoretical ambiguity associated with the mass sector of the fundamental fermions i.e., quarks, and leptons. Although the masses of all the fermions of SM are generated through the same mechanism called spontaneous symmetry breaking, and their magnitude is proportional to the interaction strength with the Higgs field, the latter's values turn out to be extremely hierarchical. The masses range from 0.5 MeV/c^2 (for electron) to 175 GeV/c^2 (top quark), thereby possessing a hierarchy of $O(10^{-6})$ to $O(1)$. The inability of SM to explain these hierarchies is termed as "Fermion mass hierarchy problem" or simply "Fermion mass problem".

One of the elegant ways to understand this problem is to let the third generation (heaviest) fermions having masses at zeroth order while the first two generations' masses arise through quantum corrections in a perturbation theory. In this work, we discuss such a mechanism in which the masses of lighter generation fermions are induced through the loops involving new gauge bosons of flavour $SU(3)_F$ and heavy fermions. In this case, the masses of second as well as first-generation fermions are generated at one-loop level only, and the hierarchy between them is adjusted by choosing the $SU(3)_F$ gauge bosons hierarchy. The latters hierarchical values are justifiable by considering the particular way of breaking, and therefore, the present model provides a realistic scenario for generating the fermion masses. The model predicts the mass of the new physics is to be larger than 10^3 TeV, which is beyond the current experimental reach.



The figure represents the hierarchical values of masses of three generations of quarks and charged leptons which are extrapolated at scale. Here m_u, m_d, and m_e represents the masses of up-quark, down-quark and electron respectively.

Source/Reference of the Work: https://doi.org/10.1007/JHEP10(2023)128

Survey of Bare Active Galactic Nuclei in the Local Universe (z < 0.2). On the Origin of Soft Excess

(***Prantik Nandi***, *Arka Chatterjee, Arghajit Jana, Sandip K Cahakrabarti, Sachindra Naik, Samar Safi-Harb, Hsiang-Kuang Chang, Jeremy Heyl)*

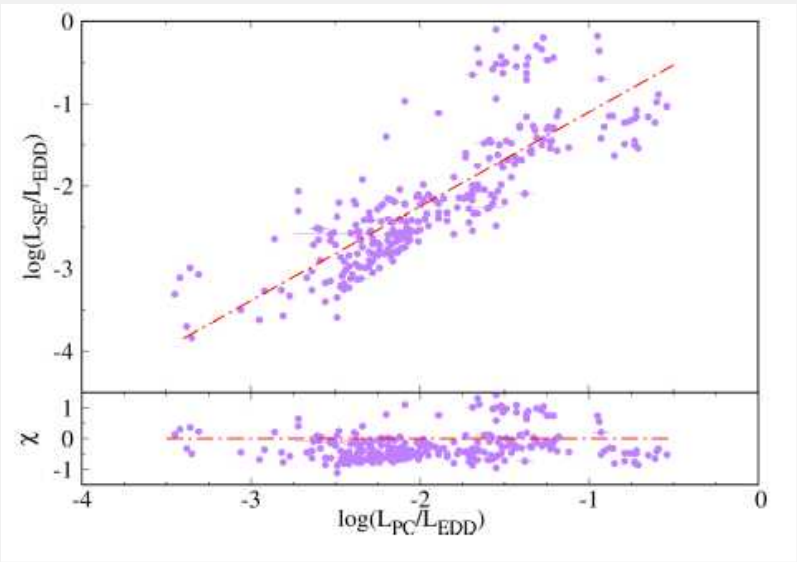
The Author

Prantik Nandi

Active Galactic Nuclei (AGNs) are one of the most energetic sources in the Universe, classified as a subclass of Super-Massive Black Holes (SMBHs). The AGNs emit radiation in the entire range of the electromagnetic spectrum, i.e., from radio to γ-rays. The extreme luminosity of the AGNs arises from the accretion of matter onto the Super Massive Black Holes (SMBHs). The accretion disk around the SMBH, formed due to mass accretion, is the source of thermal photons that undergo inverse Compton scattering in a hot electron cloud called corona. It is possible to explore the innermost regions of the accretion disk and the corona using X-ray observations. The inverse Compton scattering of thermal photons produces a power-law spectrum with a cut-off in the X-ray band. A fraction of the coronal continuum photons could get reprocessed in the colder circumnuclear matter, like a dusty torus, broad-line region (BLR), and narrow-line region, producing several spectral features, such as absorption and emission lines in the broad-band spectrum.

The soft excess, an excess emission below 2 keV, is an extraordinary feature in the X-ray spectra for most Seyfert 1 AGNs. The origin of soft excess is one of the major open questions in AGN research. Historically, blackbody radiation from the accretion disk was used to model this radiation. However, later, it was found that the characteristic temperature was much higher than the expected temperature from the standard disc. As an alternative explanation, the soft excess was attributed to reflection. Additionally, it is proposed that Comptonization in a warm, optically thick region surrounding the accretion disc could generate the soft excess. If a thermal blackbody generates the soft excess, then emission in the 0.5-2 keV range (soft excess) should lead to the 3-10 keV Comptonized primary continuum. However, this was observed in only some cases. These discoveries provoked the alternate origins of the soft excess.

Recently, Nandi et al. (2023) took a holistic approach to investigate the origin of the extraordinary feature in the soft X-ray band, called soft excess. In this work, we consider a sample of 21 Seyfert 1 AGNs that have 'bare' nuclei. The space-based X-ray observatories such as XMM-Newton and Swift/XRT have observed these sources for a long time, and we have considered the 0.5 to 10.0 keV X-ray energy band for this study. We consider the 0.5 to 2.0 keV band as soft excess emission, mostly dominated by the excess emission, and 3.0 to 10.0 keV as the primary continuum. The luminosities of the soft excess and primary continuum for the sample of sources are plotted in Figure-1. Here, we observe that these luminosities are highly correlated. From this study, we conclude that the observed correlation between the soft excess and primary continuum luminosities could have originated due to inverse Compton scattering in the Compton cloud, and both the luminosities depend on the accretion rate only.



The Correlation between the observed intrinsic luminosities of the primary continuum and soft excess in the energy range from 0.2 to 10 keV is estimated from 21 bare AGNs. A linear fit is shown on the data set by the red dotted line, and the corresponding variation of χ is also shown inthe bottom panel.

Source/Reference of the Work: https://doi.org/10.3847/1538-4365/acf4f9

High-precision electric dipole polarizabilities of the clock states in ^{133}Cs

(***A. Chakraborty*** *and B. K. Sahoo)*

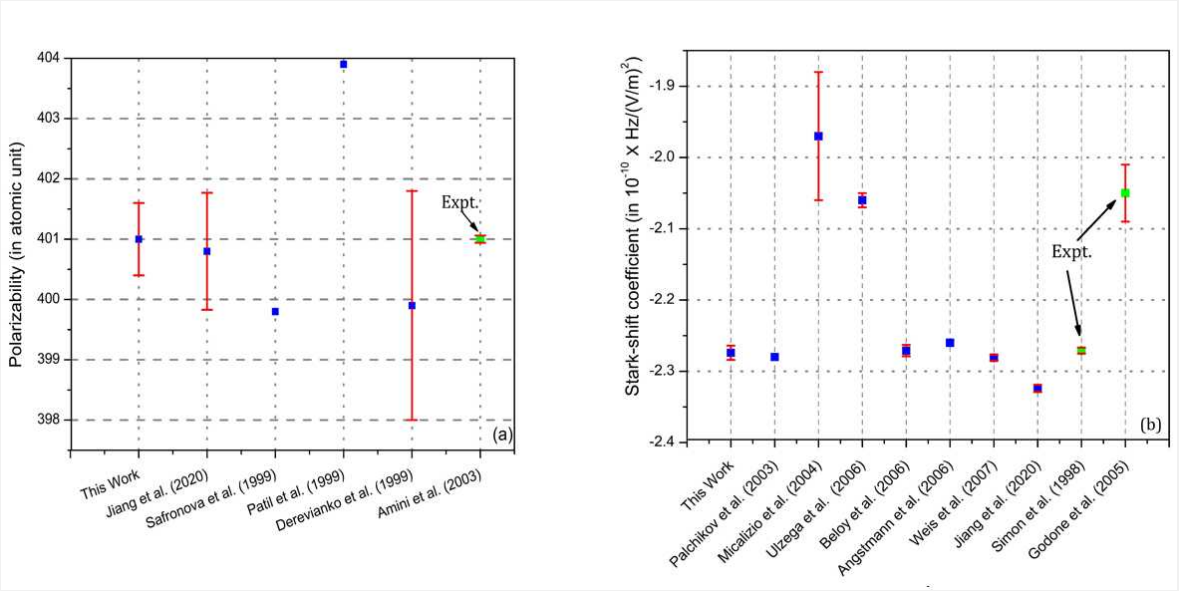
The Author

Arup Chakraborty

Atomic clocks based on the Cs and Rb atoms are frequently used for both laboratory and space applications. It is a well-known fact that ^{133}Cs atomic clock is being used as the primary time and frequency standards. In this clock, microwave transition frequency between the hyperfine levels F = 3 and F = 4 of the ground state of ^{133}Cs is used. Since accuracy of a ^{133}Cs microwave clock is limited by large systematic effects, precise determination of electric dipole (E1) polarizabilities (α_d) for estimating the Stark effects of the clock states are quite useful. Another promising avenue of application of the transition between the F = 3 and F = 4 ground-state hyperfine levels of ^{133}Cs is as qubits in quantum computers. To ensure reliable quantum control and high fidelity for these quantum applications, minimizing decoherence in single trapped atoms is imperative. Consequently, the differential shift in the clock transition between these hyperfine levels due to background blackbody radiation has recently sparked interest to estimate the α_d values accurately. Several research groups have extensively investigated the impact of electric field on the hyperfine levels of the ground state in the ^{133}Cs atom. However, there are discrepancies about 10% among the calculated results on the differential scalar E1 polarizability values from various methods. These discrepancies are further exacerbated by variation observed in various experimental results.

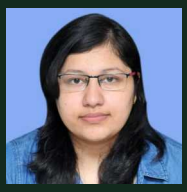
This work focuses on the precise determination of polarizabilities for the hyperfine levels of the ground state in ^{133}Cs. In this study, we precisely determine the static and dynamic electric dipole polarizabilities for the hyperfine levels of the clock transition in ^{133}Cs. For an insightful understanding of their accurate determination, we explicitly give intermediate contributions in different forms to the above quantities. Notably, our calculations exhibit strong agreement with experimental results for the static scalar and tensor components. This indicates that our estimated dynamic polarizabilities values are reliable for evaluating Stark shifts during high-precision measurements at the respective laser frequency, particularly when using the clock states of ^{133}Cs.

Source/Reference of the Work: https://doi.org/10.1103/PhysRevA.108.042818



Comparison between our computed value with existing experimental and theoretical results for the (a) scalar electric dipole polarizability of ground state of ^{133}Cs, and (b) Stark-shift coefficient of ground state of ^{133}Cs.

The Author



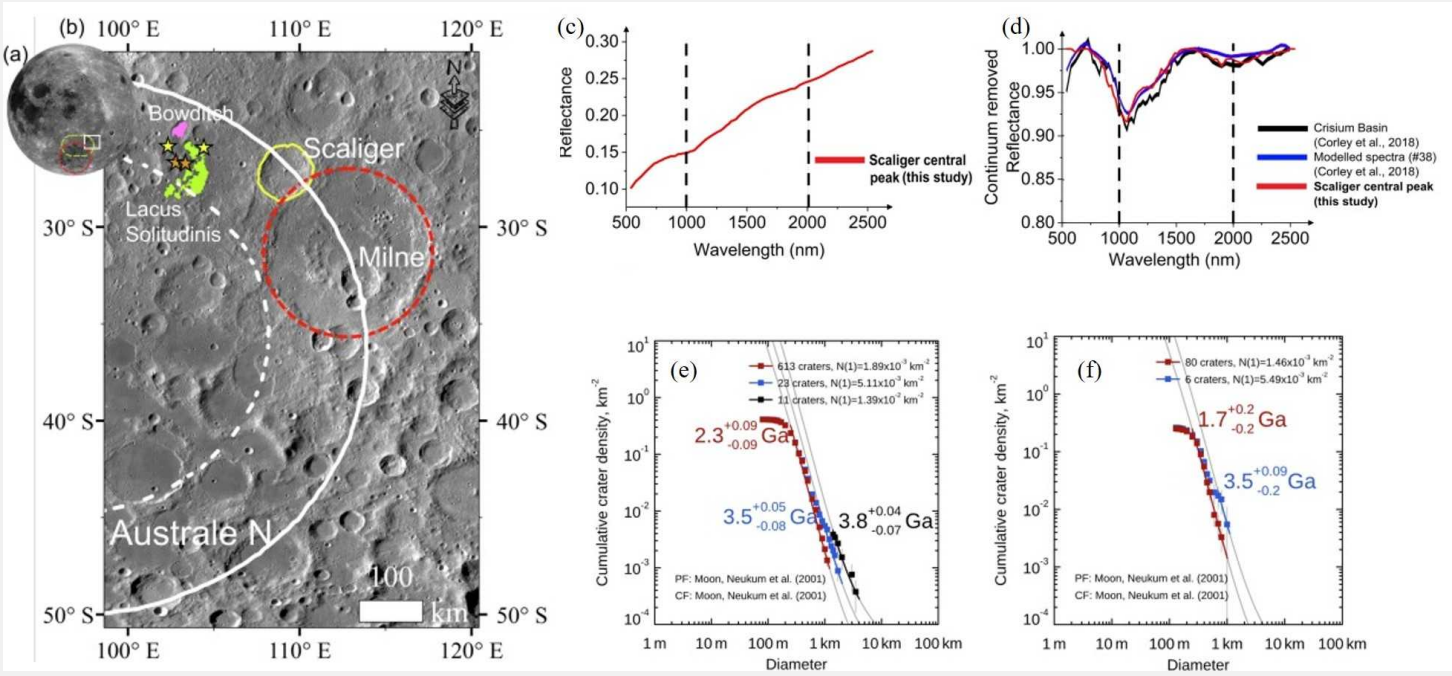
Neha Panwar

Unveiling the Australe North Basin on the Moon: Insights from the Scaliger Crater Region

(***Neha Panwar*** *and Neeraj Srivastava)*

Australe North (35.5°S, 96°E) is a ~ 880 km wide impact basin possibly older than the South Pole Aitken Basin (~ 4.2 – 4.3 Ga) on the Moon. It is a highly obliterated structure and does not show any signatures typical of large impact structure on the Moon. In this study, we, for the first time present geological evidence for the existence of the ring of the Australe North Basin that earlier could only be seen using GRAIL (Gravity Recovery and Interior Laboratory) data. The Scaliger Crater (27.1°S, 108.9°E) region in the northeastern flank of the Australe North Basin has been studied in detail to understand the influence of such large, now extinct basins, on the local geology of the Moon. The Australe North Basin is revealed to be responsible for the magmatism in the area. A mafic pluton and/or lower crustal/mantle rocks are exposed at the central peak of the Scaliger Crater, as indicated by the presence of olivine-bearing rock assemblage having a relatively higher Mg#. We also found evidence showing late-stage volcanism in the region at ~2.3 Ga inside Lacus Solitudinis and ~1.7 Ga in Bowditch Crater, suggesting that some of these ancient basins, quite far from the KREEP, can be hosts to prolonged volcanism on the Moon.

Source/Reference of the Work: https://doi.org/10.1016/j.icarus.2023.115841



(a) LROC WAC image of the Moon depicting the Scaliger Crater Region enclosed within the white square. (b) A zoomed-in view of the study area and adjoining regions from LROC WAC. (c, d) Reflectance spectra and continuum removed profile of the Scaliger Crater central peak (red). (e, f) Ages of Lacus Solitudinis and Bowditch Crater basalts respectively.

The Author

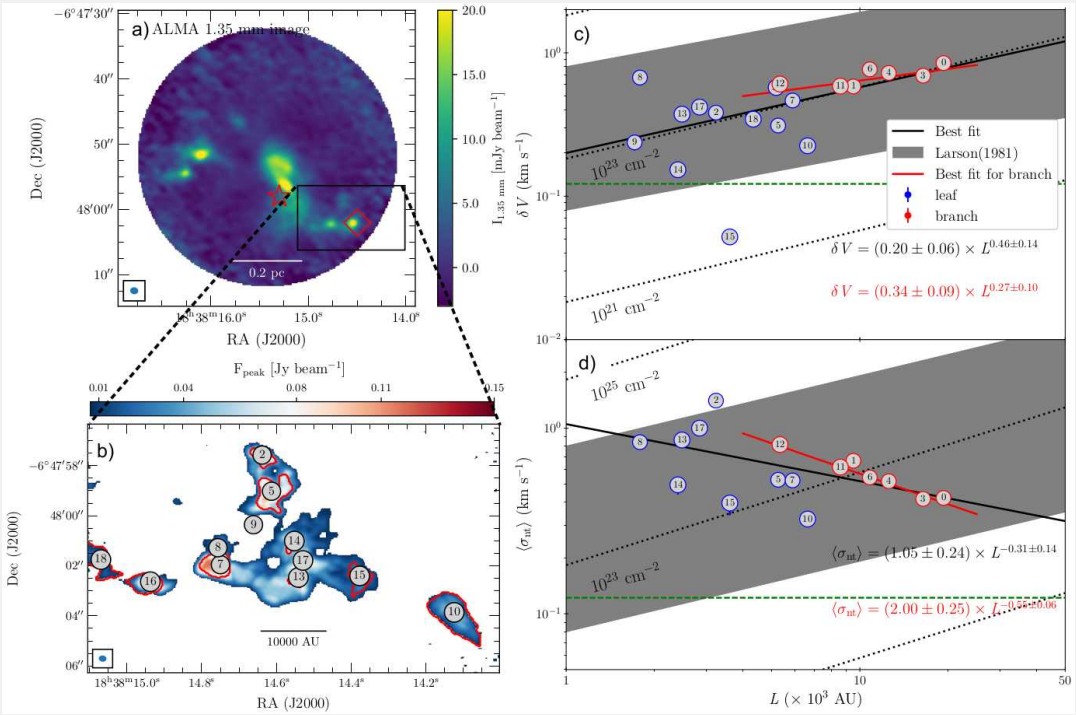
Naval Kishor Bhadari

Fragmentation and dynamics of dense gas structures in the proximity of massive young stellar object W42-MME

(***Naval Kishor Bhadari***, *Lokesh Kumar Dewangan, Lev E. Pirogov, A. G. Pazukhin, I. I.Zinchenko, Arup Kumar Maity, Saurabh Sharma)*

The formation of massive stars (M > 8 $M_{\odot}$), which immensely impact Galaxy evolution through their strong radiative and mechanical feedback, is an unsolved puzzle in astrophysics. It is now believed that massive stars form in a dense massive hub originated from converging parsec-scale gas filaments (i.e., hub-filament system (HFS)). The fragmentation of molecular clouds into cores and ultimately stars is primarily driven by the interplay between self-gravity and turbulence across various physical scales. Investigating the role of gravity and turbulence in the early stages of star formation is one of the hot topics in star formation research. Utilizing the ALMA $H^{13}CO+$ line data, obtained under project ID: #2018.1.01318.S (PI: L. K. Dewangan), this work explores the fragmentation and dynamics of gas inside a HFS in the W42 region. The region known to host a massive young stellar object (MYSO) named W42-MME (see Fig. 1a and 1b). The observational results show that the self-gravity of collapsing structures (<20,000 AU) can increase the gas velocity dispersion (or turbulence; see Fig. 1d) and mimic Larson's dispersion-size relation at constant column density (see Fig. 1c). Overall, our findings provide observational support for the hierarchical and chaotic collapse scenario in the vicinity of MYSO W42-MME, emphasizing the role of gravity-driven turbulence.

Source/Reference of the Work: https://doi.org/10.1093/mnras/stad2981



a) ALMA view of the hub in a W42-HFS hosting massive O-type star (star) and a MYSO (diamond). b) A zoom in view of the region hosting W42-MME with overlaid identified dense structures. c) Dispersion-size relations of identified structures, where L represents structure size, and δV and σ_{nt} indicate the gas velocity dispersion across and toward the dense structures, respectively. The dotted lines indicate constant column-density path.

Rotation of a Stealth CME on 2012 October 5 Observed in the Inner Heliosphere

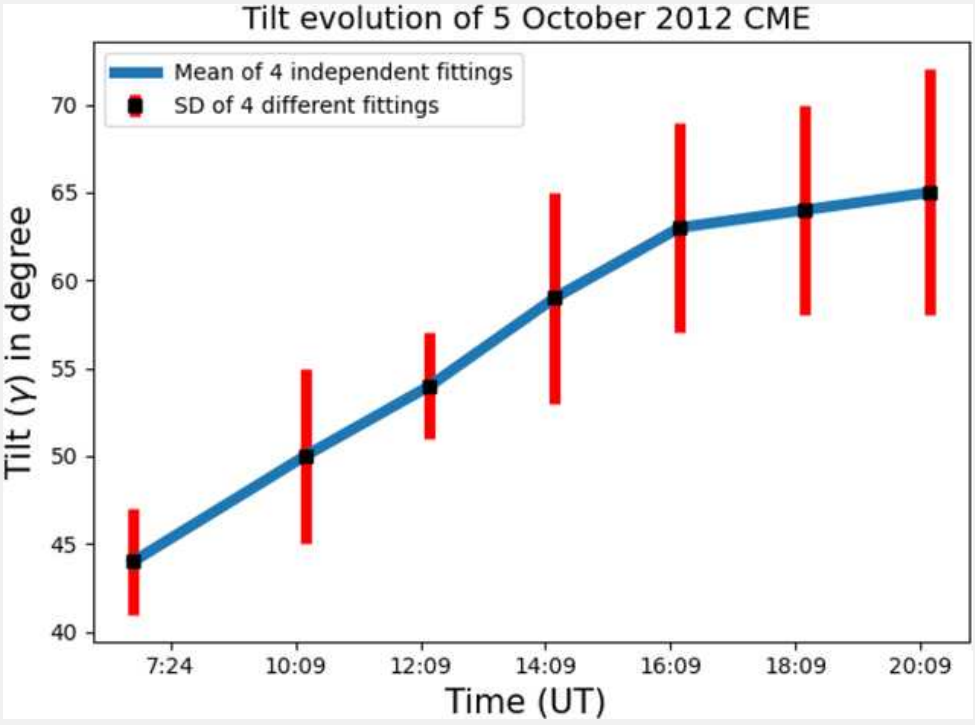
*(**Sandeep Kumar**, Dinesha V. Hegde, Nandita Srivastava, Nikolai V. Pogorelov, Nat Gopalswamy, and Seiji Yashiro)*

The Author

Sandeep Kumar

Coronal mass ejections (CMEs) are subject to changes in their direction of propagation, tilt, and other properties. This is because CMEs interact with the ambient solar wind and other large-scale magnetic field structures. We analyzed the observations of the 2012 October 5 stealth CME using coronagraphic and heliospheric images. We find clear evidence of a continuous rotation of the CME, i.e., an increase in the tilt angle, estimated using the graduated cylindrical shell (GCS) reconstruction at different heliocentric distances, up to 58 R⊙. We find a further increase in the tilt at L1 estimated from the toroidal and cylindrical flux rope fitting on the in situ observations of interplanetary magnetic field (IMF) and solar wind parameters. This study highlights the importance of observations of the Heliospheric Imager (HI), on board the Solar Terrestrial Relations Observatory (STEREO). The 2012 October 5 CME did not leave any low coronal signatures on the disk, making it difficult for forecasters to assess its impact on Earth on the basis of the near-Sun observations alone. The CME propagated at a moderate speed of 600 km s^{-1} near the Sun. However, it experienced a continuous increase in its tilt during its propagation from the Sun to the Earth. This led to a prolonged southward component of the flux rope, which was responsible for its enhanced geoeffectiveness. Our results further highlight the challenges in space weather forecasting of such stealthy CMEs. In this context, HI observations prove to be crucial and bridge the gap between the near-Sun and near-Earth observation, thereby providing an improved understanding of CME propagation in the heliosphere.

Source/Reference of the Work: https://doi.org/10.3847/1538-4357/ad011f



Time evolution of tilt of the CME of 2012 October 5 in COR2 last frame and in the HI FOV obtained from the GCS fitting. The error bars are incorporated based on four independent fittings.

Joint Inaugural Function of CSSTEAP Courses

Under the aegis of the UN-affiliated Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), the 13th Post Graduate Courses on (i) Satellite Meteorology and Global Climate (SATMET-13) and (ii) Space and Atmospheric Science (SAS-13), are being conducted at Space Applications Centre (SAC), Bopal Campus, Ahmedabad during September 1, 2023, to May 31, 2024, by Space Applications Centre (SAC) and Physical Research Laboratory (PRL) respectively. Nineteen participants representing six countries of the Asia Pacific region are attending the Courses. A joint inaugural function of the two courses was held at K. R. Ramanathan Auditorium of PRL on 6th October 2023. Shri Nilesh Desai, Director of SAC, Dr. Anil Bhardwaj, Director of PRL and senior officers from SAC and PRL graced the function. Dr. Arjit Roy, Programme Coordinator of CSSTEAP, Dehradun joined the function online.

Dr. Bhardwaj, Shri Desai and Dr. Roy welcomed the participants and presented a brief overview of PRL, SAC and CSSTEAP respectively. The participants gave a brief introduction about themselves.

Workshop on Space Weather Science and Opportunities & 2nd Indian Space Weather Conference (ISWC-2)

PRL conducted "Workshop on Space Weather Science and Opportunities" in hybrid mode during 17-18 October 2023. The workshop was focussed on introducing the fundamentals of Aeronomy, space weather and its applications to the students who are pursuing 2nd year/just completed Post-Graduation in Physics and/or allied areas.

The response received for this workshop was overwhelming. Around 300 students from various institutions including IITs, NITs, IISERs, Central and State Universities registered along with a brief write-up on their statement of purpose for attending this workshop. Overall, the registered students represented 127 academic institutions from 89 cities spread over 25 states. A total of 45 students representing more than 40 academic institutions were shortlisted for participation in in-person mode at PRL. The remaining students attended the workshop online. All the lectures on various aspects of upper atmosphere and space weather were delivered by the faculty of PRL. The topics include atmospheric structure, mesosphere-ionosphere-thermosphere dynamics, Sun, solar wind, magnetosphere and space weather impacts on day-to-day life. Visits were conducted to various labs wherein the wide variety of ground and satellite based experiments developed in-house in PRL for space weather studies were demonstrated.

The workshop was followed by the "2nd Indian Space Weather Conference (ISWC-2)" during 19-20 October 2023. ISWC-2, which was focused on deliberations on the science plans for the utilization of data from Aditya-L1 and DISHA (Disturbed and quiet time Ionosphere-thermosphere System at High Altitudes) missions, was inaugurated by Shri. A. S. Kiran Kumar, Chair, PRL Council of Management and Member, Space Commission.

In order to engage with the wider community of academia of the nation in the field of space weather science and research, participation from non-DOS institutes was especially encouraged. In all, more than 160 participants from 68 non-DOS institutions participated in ISWC-2. Principal Investigators of different payloads onboard Aditya-L1 and DISHA missions were invited to make presentations on the instruments and data products possible from each of the payloads. These were followed by contributed talks by scientists and research scholars from institutions across India. Deliberations were made on the themes: 1) Aditya-L1 mission; 2) DISHA mission 3) Solar wind processes; 4) Magnetosphere and MI coupling; 5) Space weather effects and geomagnetic storms; 6) Ionospheric processes; 7) Atmosphere – Ionosphere Coupling.

At the end of the conference, an exam was conducted for the students who participated in workshop and conference, on their understanding of the lectures given by the PRL faculty and the invited speakers of the space missions and best participants awards were given to both the offline and online participants.

Several new elements were introduced in the Space weather workshop and ISWC-2, which contributed to its grand success. One of these was engaging with the online participants through online chat by answering to their series of questions in real time by our in-house experts, the fresh Post-Doctoral Fellows and Senior Research Fellows of PRL. There was enormous appreciation of this feature in the feedback session. Events such as these contribute to awareness on available opportunities in the niche area of space weather research, and contribute to capacity building in the country.

PRL Amrut Rajbhasha Vyakhyaan - 5

The 5th lecture of "PRL Amrut Rajbhasha Vyakhyaan (PARV)" was held on October 4, 2023. Dr. Shankar Kumar Parashar, Joint Director, Rajbhasha, Branch Secretariat, Department of Space, graced the occasion as the esteemed speaker. This special lecture was organized as part of the Hindi Maah Celebration 2023 at PRL. The lecture was titled “केंद्र सरकार के कार्यालयों में राजभाषा व्यवहार” (Official Language Usage in Central Government Offices).

अपने व्याख्यान के दौरान डॉ. शंकर कुमार ने राजभाषा हिंदी से संबंधित संवैधानिक प्रावधानों के साथ-साथ राजभाषा अधिनियम, 1963, राजभाषा संकल्प, 1968 और राजभाषा नियम, 1976 में उल्लिखित दिशानिर्देशों के आवश्यक पहलुओं पर प्रकाश डाला। उन्होंने संवैधानिक प्रावधानों के अनुरूप व्यवस्थाओं के बावजूद राजभाषा कार्यान्वयन में आने वाली चुनौतियों पर चर्चा की। डॉ. शंकर कुमार ने वैज्ञानिक और तकनीकी क्षेत्र में राजभाषा कार्यान्वयन में आने वाली चुनौतियों के साथ-साथ इस संबंध में इसरो द्वारा अपनाए गए विशेष उपायों और इन प्रयासों से प्राप्त सकारात्मक परिणामों पर भी रोशनी डाली।

During his lecture, Dr. Shankar Kumar highlighted constitutional provisions related to the official language, Hindi, as well as essential aspects of the Official Language Act, 1963, the Official Language Resolution, 1968, and the guidelines outlined in the Official Language Rules, 1976. He discussed the challenges encountered in implementing the official language despite the arrangements made in accordance with constitutional provisions. Dr. Shankar Kumar also shed light on upcoming challenges in implementing the official language within the scientific and technical domain, along with the special measures adopted by ISRO in this regard and the positive outcomes derived from these efforts.

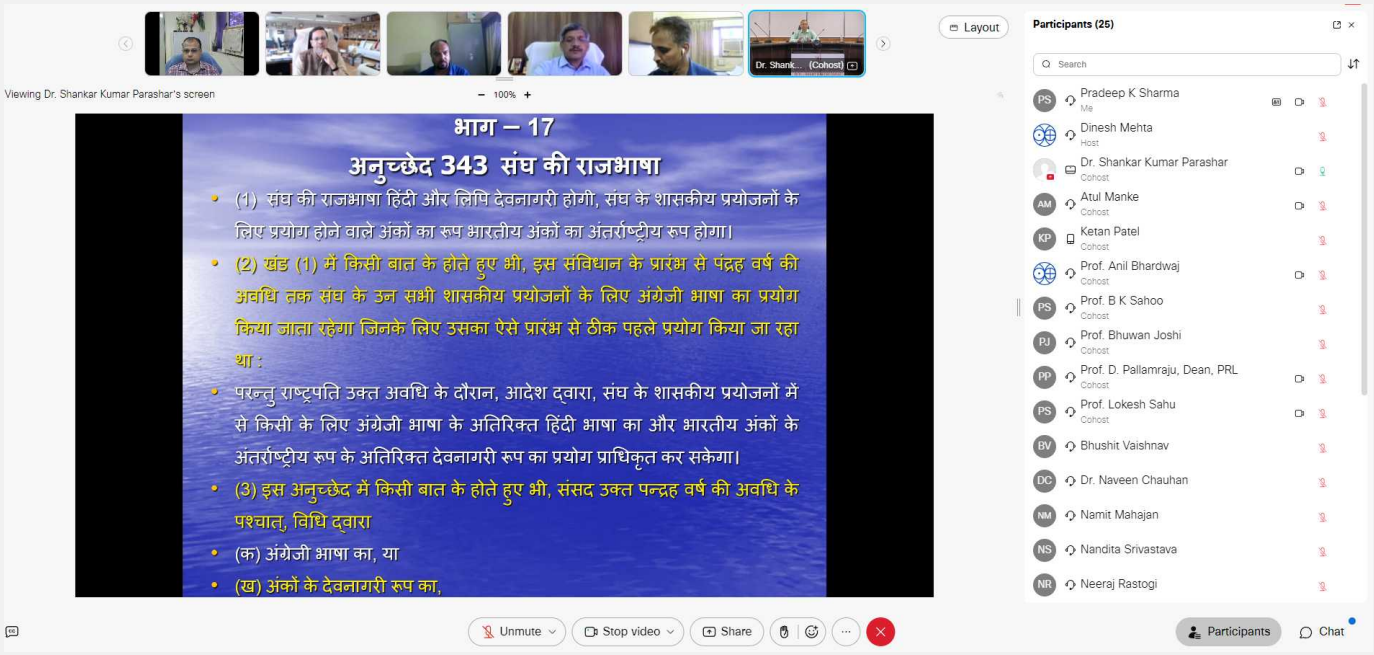
डॉ. शंकर कुमार ने अंतरिक्ष विभाग में राजभाषा कार्यान्वयन से संबंधित चल रही विभिन्न योजनाओं, जैसे सोलीस, तकनीकी सेमिनार, विक्रम साराभाई मूल पुस्तक लेखन योजना और वार्षिक राजभाषा निरीक्षण कार्यक्रम को साझा किया।

Dr. Shankar Kumar shared various ongoing schemes related to the implementation of the official language in the Department of Space, such as SOLIS, Technical Seminars, Vikram Sarabhai Original Book Writing Scheme, and the Annual Official Language Inspection programme.

व्याख्यान के बाद प्रश्न–उत्तर सत्र हुआ, जिससे प्रतिभागियों को इस विषय में गहराई से उतरने और व्यक्तिगत अंतर्दृष्टि प्राप्त करने का मौका मिला।

The lecture was followed by an engaging Question and Answer session, allowing participants to delve deeper into the subject and gain personalized insights.

You Tube Link: *https://www.youtube.com/live/rOzPyCf_Jlo?feature=shared*

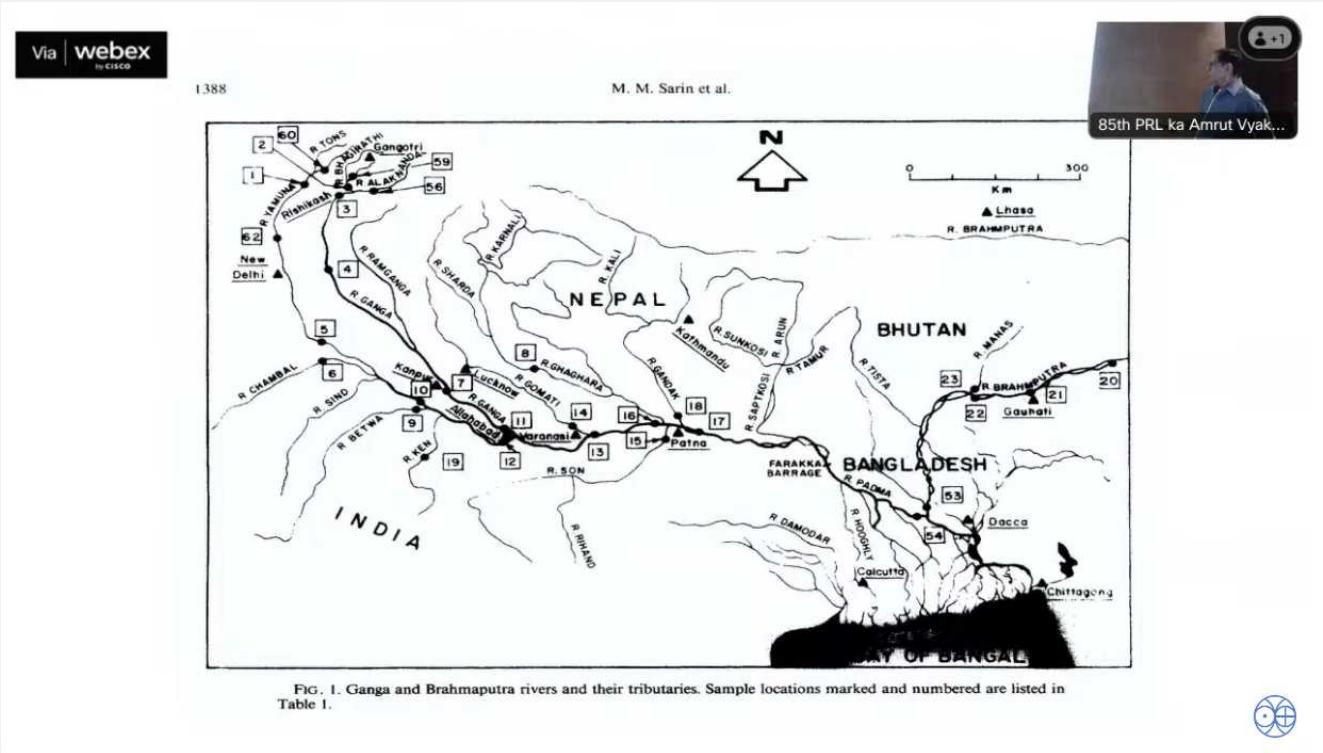


PRL Ka Amrut Vyakhyaan - 85

85th Amrut Vyakhyaan was delivered by Prof. Manmohan Sarin (SERB-Distinguished Fellow, PRL, Ahmedabad), on 31 October 2023. He talked about "Five decades of marine and atmospheric aerosol chemistry research in PRL".

Aerosols are tiny particles of solid or liquid suspended in the atmosphere. They vary widely in chemical composition, shape, and morphology. During the Vyakhyaan, Prof. Sarin highlighted the programmes that were taken up and the contribution PRL has made over the last five decades in the field of oceanographic, river, and atmospheric studies. In particular, he highlighted how the isotopic measurement and aerosol chemistry studies of PRL, helped in understanding some of the important biogeochemical and climate change aspects of the Indian subcontinent.

You Tube Link: *https://www.youtube.com/live/Un80ScwHBq4?feature=shared*



"Hamara Kaarya" Competition at USO/PRL, Udaipur

On the occasion of Hindi Maah, "Hamara Kaarya" competition was organized by Udaipur Solar Observatory, Physical Research Laboratory, Udaipur. All member offices under Town Official Language Implementation Committee (TOLIC), Udaipur were invited to participate in the said competition.

The said competition was organized on 6th October 2023 in the Main office campus of USO/PRL, Udaipur.
The main objective of this competition was to get acquainted with the important work / activities in nut shell of other member offices under Town Official Language Implementation Committee, Udaipur.

The Director, PRL and Assistant Director (Rajbhasha), PRL also joined the said programme from PRL, Ahmedabad through online mode. In his Inaugural address Dr. Anil Bhardwaj, Director, PRL greeted all the dignitaries, participants and members of USO. The Director, PRL also offered his best wishes to TOLIC, Udaipur and USO/PRL, Udaipur for conducting such programme.

In the said competition, participants from ten (10) member offices of TOLIC, Udaipur participated. The participants presented the major chores / activities of their office by using PowerPoint slides of 8 minutes duration followed by 2 minutes question & answer round in Hindi language.
The presentation of the participants were evaluated by a panel of distinguished judges comprises of –
1. Shri Giriraj Paliwal, Secretary, TOLIC, Udaipur
2. Mrs. Anju Beniwal, Asst. Professor, Meera Girls College, Udaipur, and
3. Dr. Ankala Raja Bayanna, Scientist/Engineer-SF, Udaipur Solar Observatory, Udaipur

The evaluation criteria was based on four (4) parameters –

a. Subject Matter b. Language c. Presentation style d. Time management

The said programme is also got appreciation during the half yearly Meeting of Town Official Implementation Committee, Udaipur as this was the first time where various offices got a platform to showcase their work.

Snapshots from "Hamara Kaarya" Competition at USO/PRL

हिंदी माह कार्यक्रम-2023 Hindi Month Program-2023

हिंदी माह 2023 के अंतर्गत अक्टूबर माह के दौरान निम्नांकित कार्यक्रम आयोजित किए गए थे।
The following programs were organized during the month of October as a part of Hindi Maah 2023 :

03 अक्टूबर 2023 – चित्र वर्णन प्रतियोगिता Chitra Varnan Competition:
इसका आयोजन हिंदी एवं हिंदीतर भाषी के लिए था। इस प्रतियोगिता में समय से कुछ मिनट पहले एक चित्र दिया गया। प्रतिभागी द्वारा दिए गए चित्र का वर्णन अर्थात कहानी लेखन किया जाना था। यह सभी परिसरों में एक समय पर आयोजित की गई। It was organized for Hindi and non-Hindi speaking people. In this competition, a picture was given a few minutes before the time. Description of the picture/story writing was to be done by the participants. It was organized at the same time in all the campuses.

05 अक्टूबर 2023 – 'हमारा कार्य' प्रतियोगिता 'Our Work' Competition:
"हमारा कार्य" प्रतियोगिता दो श्रेणियों में अर्थात वैज्ञानिक प्रभाग एवं तकनीकी तथा सभी प्रशासनिक अनुभागों को शामिल करते हुए आयोजित की गई। हमारा कार्य प्रतियोगिता के दोनों श्रेणियों में प्रथम, द्वितीय, तृतीय स्थान के लिए अलग–अलग पुरस्कार एवं समूह के लिए चल–शील्ड थे। "Our Work" competition was organized in two categories i.e. Scientific Division and Technical alongwith all Administrative Sections. Separate prizes for first, second, third place in both categories of the competition and running shield to the winner group of Our work was given.

07 अक्टूबर, 2023 – गायन कार्यक्रम Gayan Program:
पी.आर.एल. के सदस्य एवं उनके परिवारजनों ने इस कार्यक्रम में प्रतिभागिता की। इस के माध्यम से सदस्यों की सृजनशीलता एवं रसमधुरता का आभास हुआ। P.R.L. Members and their families participated in this program. Through this, the creativity and melodious self of the members could be glimpsed.

10 अक्टूबर, 2023 – शब्द प्रश्नोत्तरी Word Quiz Competition:
शब्द प्रश्नोत्तरी प्रतियोगिता में पी.आर.एल. को विभिन्न समूहों में विभाजित करके हिंदी भाषा ज्ञान, वर्ग–पहेली, सामान्य–ज्ञान, मुहावरों, गानों आदि का चक्र खेला गया। विजेता समूह को चल–शील्ड प्रदान किये गये। By creating in different groups in for this Program, a cycle of Hindi language knowledge, crossword puzzle, general knowledge, idioms, songs etc. was played. The winning group was given running shields. PRL members participated enthusiastically in all these programs.

13 अक्टूबर, 2023
i) लघुनाटिका Skit
इसमें विभिन्न वैज्ञानिक/तकनीकी/प्रशासन क्षेत्रों के सदस्यों द्वारा विभिन्न विषयों पर वीडियो बनाकर लघुनाटिका के रूप में प्रस्तुत की गई। सभी लघुनाटिकाओं में सामाजिक, नैतिक, वैज्ञानिक इत्यादि से संबंधित संदेश थे। In this program, members of various scientific/technical/administrative fields made videos on various topics and presented them in the form of skits. All the skits had messages related to social, moral, scientific etc., subjects.

ii) ऑन–स्टेज हिंदी नाट्य प्रस्तुति On-stage Hindi Drama presentation
इस कार्यक्रम में पीआरएल के सदस्यों द्वारा विज्ञान, अंधविश्वास एवं सामान्य जन–जीवन के विषय पर आधारित हिंदी नाट्य प्रस्तुति दी गई। यह नाट्य प्रख्यात साहित्यिक हरिशंकर परसाई जी के "भोलाराम का जीव" से प्रेरित था जो "न्यूटन दास के आत्मा की आत्म कथा" के रूप में मंचस्थ की गई। इस नाटक में व्यंग्य के माध्यम से बहुत ही संवेदनशील सामाजिक विषयों को प्रस्तुत किया गया। सभी कलाकारों ने अपने अपने किरदार बहुत ही कुशलता से निभाए। In this program, Hindi drama presentation based on the topics of science, superstition and common life was enacted by the members of PRL. This play was inspired by the famous litterateur Harishankar Parsai's "Bholaram Ka Jeev" which was staged as "Newton Das Ke Atmaa ki Atma katha". In this play, very sensitive social topics were presented through satire. All the actors played their roles very skillfully.

गतिविधियों की कुछ झलकियां *Glimpses of various activities*

Vigilance Awareness Week 2023

Based on the Circular of Central Vigilance Commission (CVC) dated 11.09.2023 and DOS endorsement thereon dated 14.09.2023, the Vigilance Awareness Week (VAW) – 2023 was observed in PRL from 30th October 2023 to 5th November 2023. The theme of the VAW-2023 was "भ्रष्टाचार को विरोध करें; राष्ट्र के प्रति समर्पित रहें" / "Say no to corruption; Commit to the Nation". All the staff Members of PRL took Integrity Pledge at their respective work places on 30.10.2023.

Apart from Integrity Pledge, all staff members were encouraged to take Integrity E-pledge in CVC portal (https://pledge.cvc.nic.in). A total of 63 PRL Staff have taken E-pledge for which online Certificates are downloadable from CVC portal. Integrity E-Pledge as an organisation has also been taken for PRL and the certificate so received is placed below.

An Essay writing competition on the occasion of VAW-2023 was also conducted on 02.11.2023 in which 16 PRLites from all the campuses of PRL had participated. The winners of this essay writing competition will be announced and awarded during the Republic Day celebration on 26.01.2024.

सत्यनिष्ठा प्रतिज्ञा

हमारा विश्वास है कि हमारे देश की आर्थिक, राजनीतिक तथा सामाजिक प्रगति में भ्रष्टाचार एक बड़ी बाधा है ।

हमारा विश्वास है कि भ्रष्टाचार का उन्मूलन करने के लिए सभी संबंधित पक्षों जैसे सरकार, नागरिकों तथा निजी क्षेत्र को एक साथ मिल कर कार्य करने की आवश्यकता है ।

इस दिशा में स्वयं को एक उदाहरण के रूप में प्रस्तुत करने तथा स्वीपाय, सत्यनिष्ठा ढांचा तथा नीति-संहिता स्थापित करने के अपने उत्तरदायित्व को हम स्वीकार करते हैं ताकि यह सुनिश्चित हो सके कि हम किसी भी भ्रष्ट आचरण का हिस्सा नहीं हैं तथा भ्रष्टाचार के दृष्टांतों पर हम अत्यधिक सख्ती से कार्रवाई करते हैं ।

हम मानते हैं कि भ्रष्टाचार उन्मूलन करने में तथा अपने कार्यों के सभी पहलुओं में सत्यनिष्ठा, पारदर्शिता तथा सुशासन के उच्चतम मानकों को बनाए रखने के लिए, एक संगठन होने के नाते हमें सामने से नेतृत्व करना होगा।

अतः, हम प्रतिज्ञा करते हैं कि:-

- हम नीतिपरक कार्य पद्धतियों को बढ़ावा देंगे तथा ईमानदारी और सत्यनिष्ठा की संस्कृति को प्रोत्साहन देंगे;
- हम ना तो रिश्वत देंगे और ना ही रिश्वत लेंगे;
- हम पारदर्शिता, जिम्मेदारी तथा निष्पक्षता पर आधारित निगमित सुशासन की प्रतिज्ञा करते हैं;
- हम कार्यों के संचालन में संबद्ध कानूनों, नियमावलियों तथा अनुपालन प्रक्रियाओं का पालन करेंगे;
- हम अपने सभी कर्मचारियों के लिए एक नीति-संहिता अपनाएंगे;
- हम अपने कर्मचारियों को उनके कर्तव्यों के ईमानदार निष्पादन के लिए, उनके कार्य से संबद्ध नियमों, विनियमों आदि के बारे में सुग्राही बनाएंगे;
- हम समस्याओं तथा कपटपूर्ण कार्यकलापों की सूचना देने के लिए समस्या समाधान तथा सूचना प्रदाता तंत्र का प्रबंध करेंगे;
- हम संबंधित पक्षों एवं समाज के अधिकारों तथा हितों का संरक्षण करेंगे

GUJARAT, 30th Oct 2023

7469247508

R.D.Deshpande
Registrar and Senior Professor
अधिकृत प्रतिनिधि
For PHYSICAL RESEARCH LABORATORY

Garba celebration at PRL-2023

Navratri, literally meaning "nine nights," is the Hindu festival dedicated to Durga—the feminine form of divinity and her nine forms. This festival is observed in many ways, each unique to the region of India in which it is celebrated. Garba is performed during Navratri, the longest and largest dance festival in the world.

Garba celebration was organized at PRL Thaltej Campus on 27.10.2023 by Staff Welfare Committee. The PRL members with their family participated in garba dressed in traditional Garba ensembles. The celebration started by offering prayers to Goddess Navdurga and then by performing Garba. Everyone was seen dancing and enjoying themselves out to the tunes of Garba. Category wise prize distribution was done at the end.

Glimpses from the Garba celebration organized at PRL on occasion of Navaratri 2023

PRL-IC Orientation Program at PRL USO

An Orientation Program for all female members of USO was held by Internal Committee (PRL-IC) in PRL, Udaipur Solar Observatory, Udaipur on 16th October 2023. Dr. Shital Patel, Chair, IC delivered a Talk regarding different issues related to IC and guided the female employees about functioning of IC. Thereafter external IC member, Prof. Anjana Vyas also delivered a speech on the above subject and shared her expertise.
Chair, IC replied to different queries of female employees regarding workplace behaviour.
The session was very interactive and received well by all.
After this session, a sensitization session was also held for all employees of USO and different topics related to workplace behaviour were discussed. This session was mainly interactive. Male and female employees actively interacted and cleared the doubts they had.
At the end of Session new brochures 2023 were distributed with complete details of members and regarding zero tolerance towards sexual harassment in PRL.

Glimpses of PRL-IC Meeting and Interactive Session in Udaipur Solar Observatory, Udaipur.

Influenza Vaccination Camp 2023

Every year Dispensary PRL organizes influenza vaccination camp for the CHHS beneficiaries. This vaccine is beneficial to provide immunity and protect them against the possible influenza infection for next 11 – 12 months. Though this vaccine can be taken at any time throughout the year, the best time to inject this is between August to November. This is because the chances of Flu infections spread are highest during the winter.

CHHS beneficiaries were informed about this camp well in advance by circulation of Notice through all users' mail, PRL Notices Site, PRL Retried Portal and by telephonic communication. The message was also conveyed to the CHHS beneficiaries during their visit to dispensary for one or other reason. More than 240 beneficiaries had registered themselves by filling necessary details in the circulated Google Form. Registered beneficiaries were allotted different time slot to avoid mass gathering at the camp and informed about it through respective E-mail.

The influenza vaccination camp was held at Dispensary Navrangpura PRL on 30.10.2023 and 31.10.2023. The beneficiaries were given Tetravalent Flu vaccine (Vaxiflu-4). Total 250 beneficiaries were covered under Anti-flu vaccination during this camp.

Benefits of influenza vaccination:

1. Protect the beneficiaries against seasonal flu including H1N1
2. Reduces the risk of flu –associated hospitalization.
3. Important preventive measure for people with co-morbid conditions like lung diseases, High BP, Diabetes, Cardiac conditions.

Dispensary PRL conveys heartiest thanks to all CHHS beneficiaries for making this influenza vaccine camp successful.

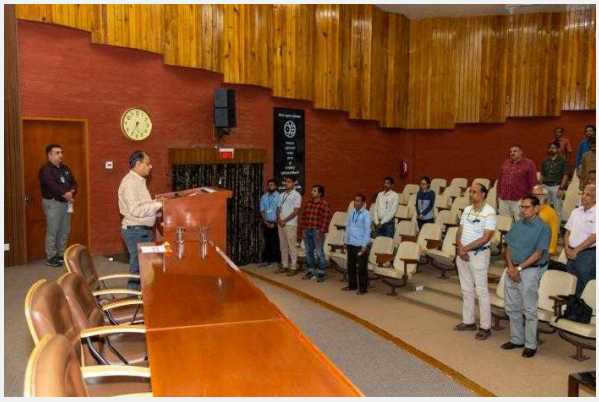
Moments captured during the vaccination camp

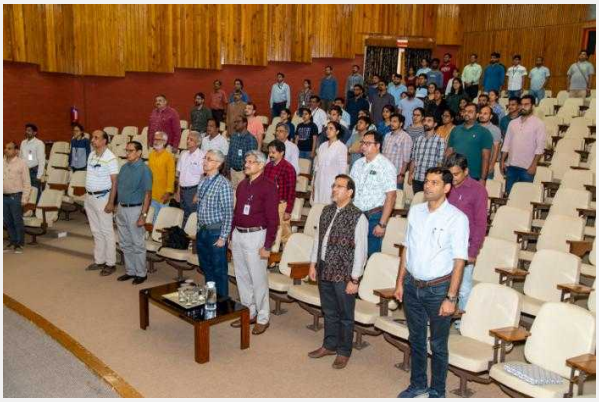
National Unity Day 2023

National Unity Day is an initiative celebrated every year to commemorate Sardar Vallabhbhai Patel's birth anniversary. Sardar Patel was born on 31st of October in 1875 in Gujarat. Rashtriya Ekta Diwas (National Unity Day) provides an opportunity to reaffirm the inherent strength and resilience of our nation to withstand the actual and potential threats to the unity, integrity and security of our country. This year marks the 148th birth anniversary of the freedom fighter. Sardar Patel played a major role in the integration of India (Ek Bharat) from over 560 princely states. To acknowledge his efforts in uniting the nation, India celebrates National Unity Day on his birth anniversary.

Followed by the PRL ka Amrit Vyakhyan on 31st October, 2023, the activity started with a pledge taking ceremony that embarked the spirit of unity among everyone. The PRL members took the pledge to preserve the unity and integrity of the nation and spread this message among the countrymen.

Further, to earmark the birth anniversary of Sardar Vallabhbhai Patel and National Unity Day, the Unity/Ekta Rally was organised at PRL Main campus starting from K. R. Ramanathan Auditorium to Vikram Sarabhai statue at main gate and back to the Administration lawn. PRL members (Permanent staff members, Research Scholars, Project Associates, Post-Doctoral Fellows, Trainees, contractual manpower) joined this Ekta rally, a few holding national flags too. This significant program engraved the spirit of "Ekta" amongst all the PRL members.





Scenes from the gathering

PRL Monthly Publications Digest (October 2023)

Astronomy & Astrophysics Division [4]

1. Suman Bala, Sujay Mate, Advait Mehla, Parth Sastry, N. P. S. Mithun, Sourav Palit, Mehul Vijay Chanda, Divita Saraogi, C. S. Vaishnava, Gaurav Waratkar, Varun Bhalerao, Dipankar Bhattacharya, Shriharsh Tendulkar, Santosh Vadawale, Prospects of measuring gamma-ray burst polarization with the Daksha mission, Journal of Astronomical Telescopes, Instruments, and Systems, Date of Publication: 31/10/2023

2. Pandey, Rakesh, Sharma, Saurabh, Dewangan, Lokesh Kumar, Ojha, D. K., Panwar, N. et al., Dissecting the morphology of star forming complex S193, Monthly Notices of the Royal Astronomical Society, stad2944, https://doi.org/10.1093/mnras/stad2944, Date of Publication: 28/10/2023

3. S. Mondal, A. Salgundi, D. Chatterjee, A. Jana, H. K. Chang, Sachindra Naik, Evolution of low frequency quasi-periodic oscillations in GX 339-4 during its 2021 outburst using AstroSat data, 2023, Monthly Notices of the Royal Astronomical Society, 526, 4718, Date of Publication: 27/10/2023

4. Bhadari, N. K., Dewangan, Lokesh Kumar, Pirogov, L. E., Pazukhin, A. G., Zinchenko, I. I., Maity, A. K., Sharma, Saurabh, Fragmentation and dynamics of dense gas structures in the proximity of massive young stellar object W42-MME , Monthly Notices of the Royal Astronomical Society, Volume 526, Issue 3, pp.4402-4417, Date of Publication: 18/10/2023

Atomic Molecular and Optical Physics Division [2]

1. A. Chakraborty and B. K. Sahoo, 2023, High-precision electric dipole polarizabilities of the clock states in 133Cs, Phys. Rev. A 108, 042818 ; https://doi.org/10.1103/PhysRevA.108.042818, Date of Publication: 25/10/2023

2. B. K. Sahoo, Nodoka Yamanaka, and Kota Yanase, 2023, Revisiting theoretical analysis of the electric dipole moment of 129Xe, Phys. Rev. A 108, 042811; https://doi.org/10.1103/PhysRevA.108.042811, Date of Publication: 16/10/2023

Geosciences Division [5]

1. Ratnaparkhi, A., Dave, D., Meena, R., Rastogi, N., Bergin, M., and Ghoroi, C., 2023, Is hydrophobic coating on glass equally efficient in reducing % soiling loss of solar PVs in clean and polluted environments?, Solar Energy, Date of Publication: 30/10/2023

2. Abdur Rahman, Rayees Ahmad Shah, Ajayeta Rathi, M.G. Yadava, Sanjeev Kumar, 2023, Transport pathways of black carbon to a high mountain Himalayan lake during late Holocene: Inferences from nitrogen isotopes of black carbon, Palaeogeography, Palaeoclimatology, Palaeoecology, Date of Publication: 23/10/2023

3. Yogita Kadlag, David Haberthür, Ingo Leya, Ruslan Hlushchuk, and Klaus Mezger, Physical properties and average atomic numbers of chondrules using computed tomography, Planetary and Space Science, Date of Publication: 17/10/2023

4. Pandisamy Ragavan, Abdur Rahman, Siddhartha Sarkar, ·Sangeeta Verma, Chinnusamy Jeeva, Pakkirisamy Mohan, Sanjeev Kumar, Variability in soil organic carbon stock and isotopic signature in tropical island mangrove forests of India, Regional Environmental Change, Date of Publication: 16/10/2023

5. Dumelié, N., Vernier, J., Berthet, G., Vernier, H., Renard, J., Rastogi, N., Wienhold, F., Combaz, D., Angot, M., Burgalat, J., Parent, F., Chauvin, N., Albora, G., Dagaut, P., Benoit, R., Kovilakam, M., Crevoisier, C., & Joly, L., Toward Rapid balloon Experiments for sudden Aerosol injection in the Stratosphere (REAS) by volcanic eruptions and wildfires, Bulletin of the American Meteorological Society, Date of Publication: 16/10/2023

Space & Atmospheric Sciences Division [2]

1. Sourita Saha, Dharmendra Kumar Kamat, Som Sharma, Prashant Kumar, Kondapalli Niranjan Kumar, Hassan Bencherif, Shyam Lal, Satish Chandra, Response of the boundary layer clouds to the surface forcings: A case study of western India, Remote Sensing Applications: Society and Environment, Date of Publication: 16/10/2023

2. S. Ramachandran, Maheswar Rupakheti, R. Cherian and Mark G. Lawrence, 2023, Aerosols heat up the Himalayan climate, Science of the Total Environment, Date of Publication: 01/10/2023

Planetary Sciences Division [3]

1. Neha Panwar, Neeraj Srivastava, Scaliger Crater Region on the Moon: Implications for the Australe North Basin and magmatism in the region, Icarus, Date of Publication: 21/10/2023

2. Saranya R. Chandran, James S., Aswathi J., Devika P., Sadeeda M., R.B. Binoj Kumar, Anil Chavan, Subhash Bhandari, K.S. Sajinkumar, A compendium of the best-preserved terrestrial hypervelocity impact crater in a basaltic terrain: The Lonar, India, Earth-Science Reviews, Date of Publication: 21/10/2023

3. Richa N. Jain, R. K. Choudhary, Anil Bhardwaj, T. Imamura, Anshuman Sharma, and Umang K. Parikh, Turbulence dynamics and flow speeds in the inner Solar Corona: Results from radio-sounding experiments by the Akatsuki spacecraft, Monthly Notices of the Royal Astronomical Society, 525, Issue 3, pp.3730–3739 (2023)., Date of Publication: 21/10/2023

Theoretical Physics Division [2]

1. Gurucharan Mohanta, Ketan M. Patel, 2023, Gauged SU(3) and loop induced quark and lepton masses, JHEP10 128, Date of Publication: 20/10/2023

2. Animesh Chatterjee, Srubabati Goswami, Supriya Pan, Probing mass orderings in presence of a very light sterile neutrino in a liquid argon detector, Nuclear Physics B, Date of Publication: 11/10/2023

Awards & Honours

(1) **Prof. D. Pallamraju,** Senior Professor, Space and Atmospheric Sciences Division of PRL has been invited **as an expert member of Board Of Studies (BoS)** in the field of Physics, in the **MIT-World Peace University, Pune.**

Visitors

1) The following team of Researchers have visited PRL on 12th & 13th October 2023 and had a meeting with the Director and the Dean of PRL:-

a. Dr. Penna Suprasanna - Dean Research & Head of Amity Institute of Biotechnology
b. Dr. R. Selvakumaran - Assistant Professor, Amity Centre of Excellence in Astrobiology
c. Dr. Sneha Gokani - Ramanujan Fellow, Amity Centre of Excellence in Astrobiology

2) Shri Nilesh M. Desai, Director, SAC and other 34 Staff members of SAC, Ahmedabad have attended the joint inaugural function of the CSSTEAP courses SAS-13 and SATMET-13 at PRL on 6th October 2023.

3) Mr. Herman Walter Johan Russchenberg, Technical University (TU), Delft Climate Institute, Netherlands has visited PRL from 08.10.2023 to 11.10.2023 in connection with Scientific discussions on aerosols, clouds, their radiative and climate impacts and interaction with Scientists and Research Scholars.

4) Ms. Aayushi Raval, a M.Sc. Applied Physics student from M.S. University, Vadodara visiting PRL from 01.10.2023 to 31.03.2024

Heartily welcome to our new members

NAME: Mr. Mannyash Jain

DESIGNATION: Scientist/Engineer-SC

DATE OF JOINING: 26.09.2023

DIVISION/AREA: Space & Atmospheric Science Division

NAME: Mr. Vibhor Agrawal

DESIGNATION: Scientist/Engineer-SC

DATE OF JOINING: 26.09.2023

DIVISION/AREA: Planetary Science Division

NAME: Mr. Churchil Dwivedi

DESIGNATION: Scientist/Engineer-SC

DATE OF JOINING: 26.09.2023

DIVISION/AREA: Astronomy & Astrophysics Division

NAME: Mr. Dheeraj Kumar Khonde

DESIGNATION: Scientist/Engineer-SC

DATE OF JOINING: 26.09.2023

DIVISION/AREA: Space & Atmospheric Science Division

NAME: Ms. Akhila P. N

DESIGNATION: Accounts Officer (On Deputation)

DATE OF JOINING: 04.10.2023

DIVISION/AREA: Accounts Section

NAME: Mr. Solanki Steven Alois

DESIGNATION: Purchase & Stores Officer (On Deputation)

DATE OF JOINING: 04.10.2023

DIVISION/AREA: Purchase Section

NAME: Ms. Saloni Rajesh Mishra

DESIGNATION: Junior Research Fellow-SERB-DST-SWARNAJAYANTI Fellowship

DATE OF JOINING: 09.10.2023

DIVISION/AREA: Geoscience Division

NAME: Mr. Krishna Dhanunjayachari

DESIGNATION: Accounts Officer (On Deputation)

DATE OF JOINING: 16.10.2023

DIVISION/AREA: Accounts Section

NAME: Ms. Neha

DESIGNATION: Junior Research Fellow-SERB-DST-CRG

DATE OF JOINING: 23.10.2023

DIVISION/AREA: Planetary Science Division

NAME: Mr. Akshat Rawat

DESIGNATION: Junior Research Fellow -SERB-DST-CRG

DATE OF JOINING: 25.10.2023

DIVISION/AREA: Planetary Science Division

NAME: Mr. Alaxender Panchal

DESIGNATION: Post Doctoral Fellow

DATE OF JOINING: 26.10.2023

DIVISION/AREA: Astronomy & Astrophysics Division

NAME: Ms. Sanchita Banerjee

DESIGNATION: Post Doctoral Fellow

DATE OF JOINING: 30.10.2023

DIVISION/AREA: Geoscience Division

Obituary

Name of the employee	Shri K. S. Lali
Designation at the time of superannuation	Engineer-SE
Date of Birth	24.05.1939
Date of Joining PRL	21.11.1966
Date of Superannuation	31.05.1999

Teary Eyes for our Departed Member

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Jigar Raval, CNIT Division

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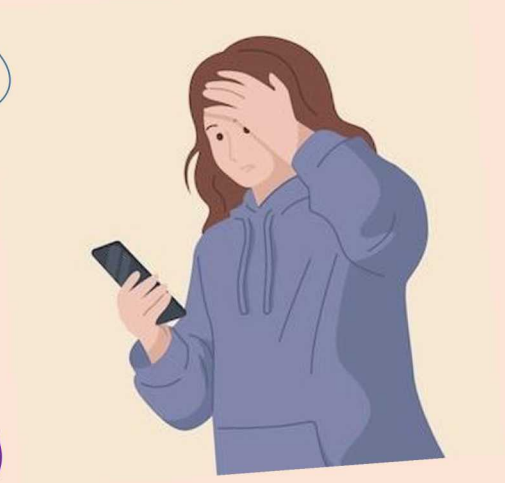

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