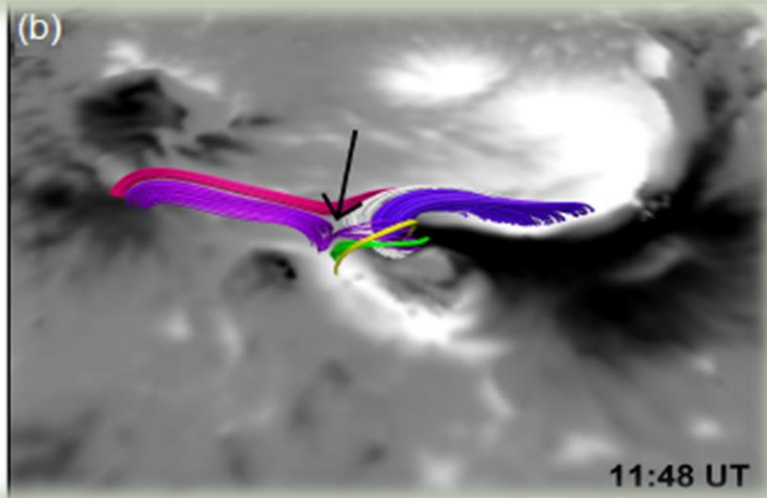
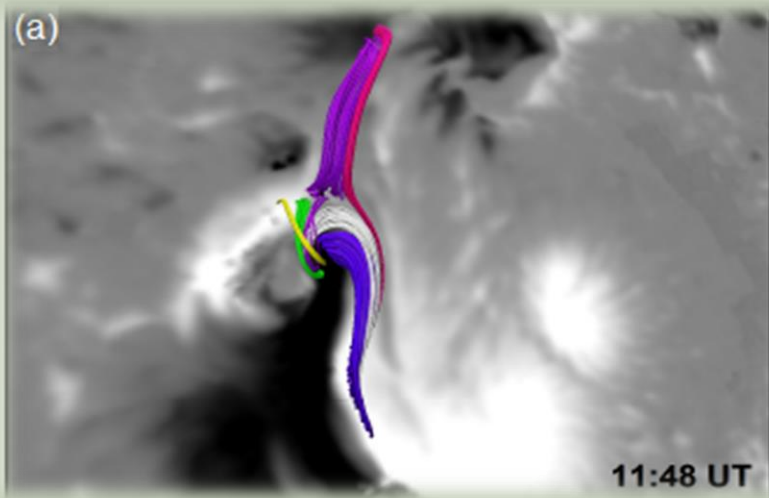
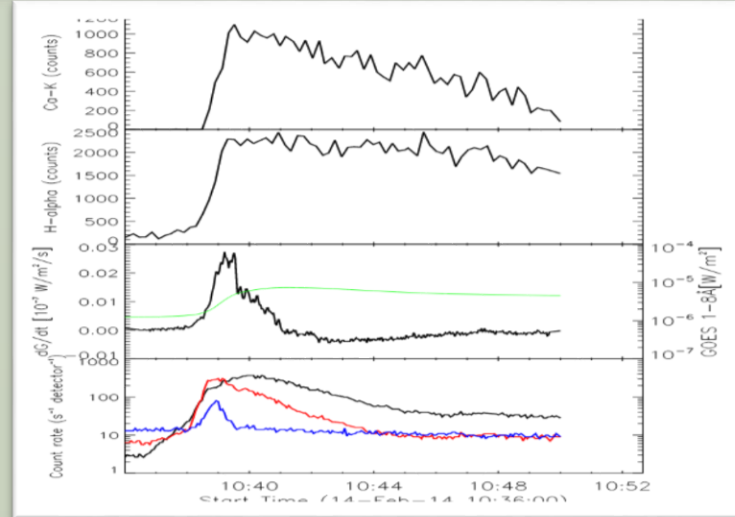
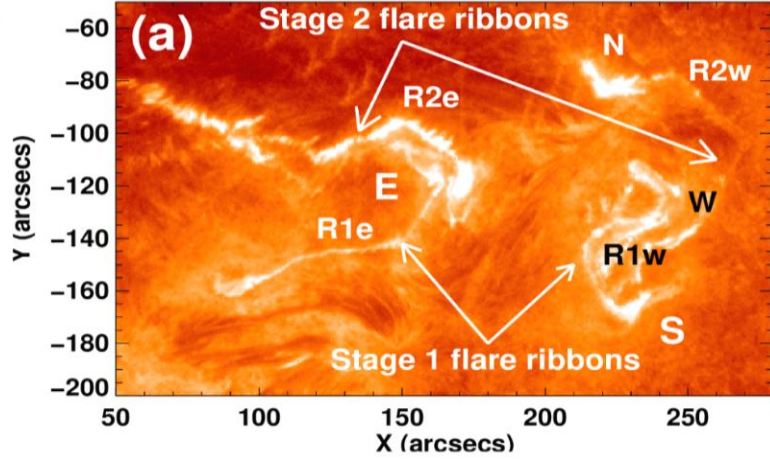




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Electromagnetic opacity of complex dusty plasmas (S. K. Mishra and Shikha Misra)

The fine particles immersed in plasma act as floating probes and practically can be interpreted as the source and sink of the plasma particles. The particles acquire a finite potential and their presence significantly influences the dust-free plasma equilibrium and constituent configuration, resulting in substantial alteration of the physical and transport properties. On the basis of kinetic modeling, the steady-state transport properties of the complex plasma comprising of size distributed dust and external electromagnetic perturbations, have been investigated. As novelty, the analysis manifests the mutual dependences of coexisting transient physical processes of the grain charging, plasma density/ temperature perturbation, energy exchanges and Ohmic heating of plasma electrons in developing the kinetics. The plasma transport features are derived in terms of electrical conductivity, thermal diffusivity, dielectric constant and refractive index. As an important outcome, in the absence of external electric field, the transparency of the dark complex plasma increases as the dust distribution shifts towards the larger particle size, while an optical opacity is anticipated in the case of the illuminated plasmas where the photoemission of electrons from the dust particles plays a dominant role in describing the plasma configuration. Another significant observation is that Ohmic heating in the presence of external electric fields (steady/ alternating) lead the resulting complex plasma towards electromagnetic (em) opacity or overdense regime of operation. The outcome is of significance in space and laboratory plasmas where the dust, plasma, and fields coexist. <https://doi.org/10.1063/1.5085113>



Sanjay Mishra

Generalisation of the Magnetic Field Configuration of typical and atypical Confined Flares

(Navin Chandra Joshi, Xiaoshuai Zhu, Brigitte Schmieder, Guillaume Aulanier, Miho Janvier, Bhuwan Joshi, Tetsuya Magara, Ramesh Chandra, Satoshi Inoue)



Navin Joshi

Atypical flares cannot be naturally explained with standard models. To predict such flares, we need to define their physical characteristics, in particular, their magnetic environment, and identify pairs of reconnected loops. Here, we present in detail a case study of a confined flare preceded by flux cancellation that leads to the formation of a filament. The slow rise of the non-eruptive filament favours the growth and reconnection of overlying loops. The flare is only of C5.0 class but it is a long duration event. The reason is that it is comprised of three successive stages of reconnection. A nonlinear force-free field extrapolation and a magnetic topology analysis allow us to identify the loops involved in the reconnection process and build a reliable scenario for this atypical confined flare. The main result is that a curved magnetic polarity inversion line in active regions is a key ingredient for producing such atypical flares. A comparison with previous extrapolations for typical and atypical confined flares leads us to propose a cartoon for generalizing the concept.

<https://doi.org/10.3847/1538-4357/aaf3b5>

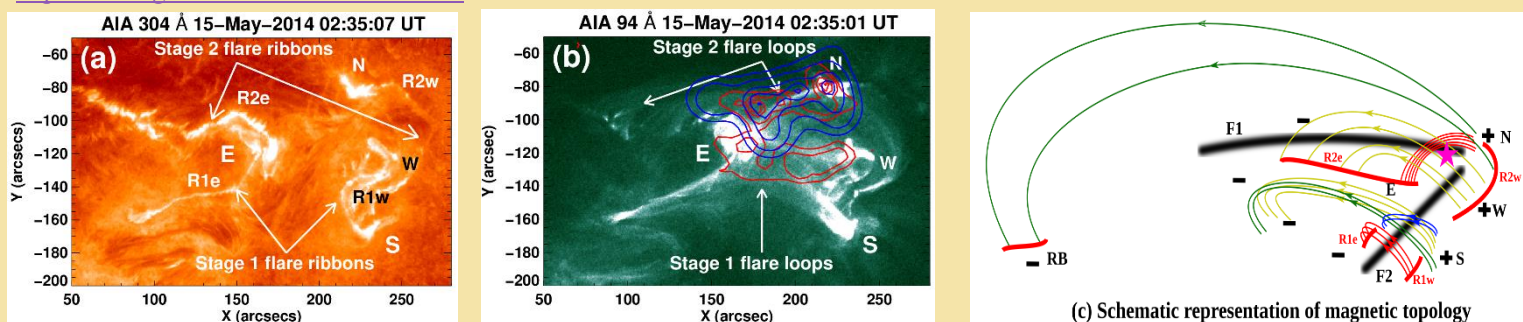


Figure: (a) SDO/AIA 304 Å image showing both the first (R1e and R1w) and second (R2e and R2w) set of flare ribbons formed during the stages 1 and 2 of the event, respectively. (b) SDO/AIA 94 Å image showing the flare loops connecting the flare ribbons. The loops joining the regions E to S and E to N are the reconnected loops formed during stages 1 and 2 of the flare, respectively. The red and blue contours in panel (b) represent the RHESSI X-ray sources of 6 – 12 and 12 – 25 keV energy bands, respectively. (c) Schematic representation showing the magnetic topology. Green and blue lines are the pre-reconnected lines, while the red and yellow lines are the post-reconnected lines, respectively. Pink star shows the regions of magnetic reconnection.

Study of reconnection rates and light curves in solar flares from low and mid chromosphere

(Sindhuja G, Nandita Srivastava, A. M. Veronig, W. Pötzi)

We study the flare evolution process using both H α and Ca-K data sets to understand the variations at low and mid chromospheric layers respectively. The reconnection rates and fluxes at these layers were estimated using the high cadence Ca-K and H α time lapse images and low-noise 720-s line-of-sight magnetograms. Nine flare events observed during 2010–2015 from Kanzelhöhe Solar Observatory for Solar and Environmental Research were analyzed for the study. The study shows that the reconnection flux estimated from Ca-K and H α follow a similar trend and shows a linear relation in the log-log plot. The study also reveals that Ca-K light curve during the course of the flare is dominated by impulsive and gradual components and follows the trend of the non-thermally dominated Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) (25–50 keV) light curves. Whereas, H α light curve is dominated by a gradual component and follows the trend and shape of the thermally dominated RHESSI HXR (6–12 keV) light curves. The results suggest the significance of H α and Ca-K observations in understanding the gradual and impulsive phases of flare evolution processes. <https://doi.org/10.1093/mnras/sty2887>



Nandita Srivastava

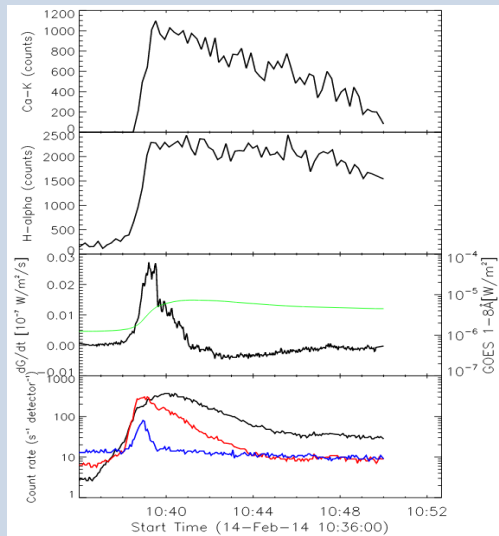
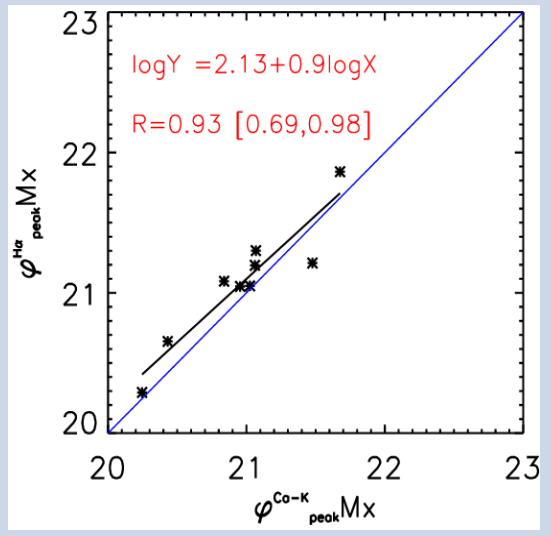


Figure: (Right) Scatter plot of the total reconnection fluxes (right-hand panel) of Ca-K versus H α . The correlation coefficient (R), 95% confidence intervals are given in the inset. The black line shows the straight line fitting for the data. 1:1 correspondence line is also overplotted (blue).

Figure: (Left) Light curves in Ca-K, H α , and GOES 1–8 Å soft X-ray flux (green) together with its time derivative (black) and RHESSI HXR count rates for the energy bands 6–12 keV (black), 12–25 keV (red), and 25–50 keV (blue) for a C7.2 confined flare.



Successive flux rope eruptions from δ -Sunspots region of NOAA 12673 and associated X-class eruptive flares on 2017 September 6

(Prabir K. Mitra, Bhuwan Joshi, Avijeet Prasad, Astrid M. Veronig, and R. Bhattacharyya)



Prabir Mitra

Flares are sudden flashes occurring in the solar atmosphere releasing huge amount of energy (10^{27} - 10^{32} erg) within a short time. During 2017 September, when the Sun was at minimum activity period, an active region (AR) NOAA 12673 produced 4 X-class and 27 M-class flares within a week. We carried out multi-wavelength analysis of the two homologous X-class flares that occurred on 2017 September 6 within an interval of nearly 3 hours and investigated their triggering processes. Notably, the second of these two X-class flares is the largest solar flare in the solar cycle 24. Coronal images of the AR in the pre-flare phase displayed a reverse S-shaped structure (coronal sigmoid; Figure 1(a)) which is considered to be an indicator of twisted or helical magnetic structures called flux ropes. The flare was initiated as the core of the sigmoid became activated (Figure 1(b)) and erupted resulting into a coronal mass ejection (CME). The late phase of the X9.3 flare was characterized by the formation of an extended arcade of post-flare coronal loops. Non-force-free-field (NFFF) extrapolation results in the pre-flare phase confirms the presence of the flux rope (Figure 2) at the core of the sigmoid associated with a magnetic null point, as well as, an X-type magnetic configuration which are considered to be potential triggering agents. In view of the flux rope and its association with the magnetic null point, our observations and analysis support the ‘breakout model’ for solar eruptions. <https://doi.org/10.3847/1538-4357/aaed26>

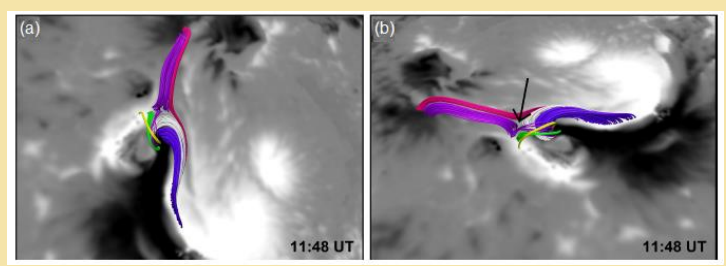
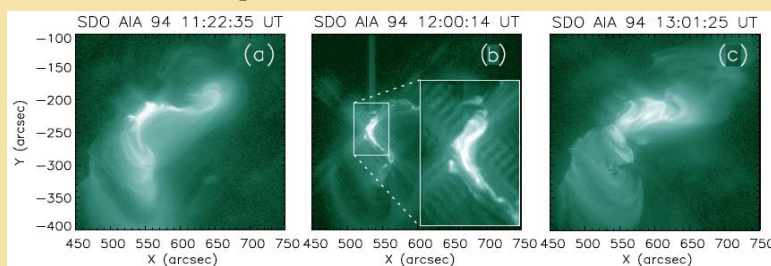


Figure 1 (left): AIA 94 Å images showing the coronal configuration of the active region NOAA 12673 during the pre-flare phase (panel (a)), impulsive phase of the X9.3 flare (panel (b)), and the late gradual phase (panel (c)). The flare was initiated from the middle of the active region which is shown in the zoomed cutout inside panel (b). **Figure 2 (right):** NFFF extrapolation results indicating a flux rope (shown by blue lines) associated with a magnetic null points (shown by the arrow in panel (b)) and two sets of field lines making an X-type configuration.

Total Eye Care – An Interactive Session



Vision is one of the most beautiful senses nature has gifted to human kind. Eyes, don't just see, they also speak, communicate and create a picture of future in our minds. Unfortunately, we are facing Cataract, Glaucoma and other sight threatening conditions not just in old but also in young age these days. The incidences of eye diseases are increasing due to pollution, stress, increasing use of mobiles and many more reasons. To understand and to create awareness for various age-related eye sight problems, an interactive lecture was arranged in PRL on 25th February 2019. Dr Shashank Rathod, a senior eye surgeon from Eye Care Hospital was invited to give a talk on Total Eye Care. It was very informative and useful lecture for basic eye care. Moreover, people have learnt not to ignore the common eye problem as it may be the symptom of underlying serious issues. Beneficiaries are specifically given the message for early diagnosis and prompt management of eye diseases to prevent any further serious consequence.

Swachhta Pakhwada observed at PRL

Swachhta Pakhwada-2019 was celebrated during 01.02.2019 to 15.02.2019 at PRL. The theme of this year's campaign was "Plastic Free Campus" and the event saw several innovative programmes to create awareness for a clean and healthy work space and residences. To begin with, a mass pledge was taken by PRL employees to contribute to the Swachh Bharat Campaign, arrangements for e-pledge were also made, in which about 100 people participated.

A lecture on "Weeding out of records" was delivered by Shri Sangeet Mishra, Sr. Admin. Officer, SAC, Ahmedabad. Keeping in view this year's theme, a competition was announced for giving innovative

ideas/models on the theme "Alternative to Plastic PET Water bottles". Also, a drawing competition on the Theme "No Plastic & No Tobacco" was conducted at Thaltej campus for the Children of PRL Employees and CISF Employees. In addition, Cleanliness Campaign along with plantation of saplings was carried out in Navrangpura & Vikram Nagar PRL residential Colonies. Residents of both the colonies along with students from Navrangpura Hostel had participated in large numbers for sloganeering, plantations etc. A similar campaign was also carried out at PRL Thaltej Campus.

During the fortnight long campaign, an Awareness lecture on "No Plastic and No Tobacco" was delivered by Dr. Samir Dani to the Contract workers of PRL. Dr. Dani apprised them of the health hazards of using Tobacco based products and expenses involved in treatments of ailments caused due to Tobacco use. The workers pledged not to use any form of tobacco".



A Medical Camp was organised at Ramdev Nagar slum Area by the Medical Team at PRL. The main focus was hygiene and women health. A large number of slum dwellers especially women took part in the Camp. A Medical Kit consisting of First-Aid material was distributed among the slum dwellers for their daily use. Solar LED system was commissioned by Director, PRL, as a step towards using green and renewable energy. The programme concluded with a formal prize distribution ceremony to the children who participated in the drawing competition.



UN students' scientific tour to Mt Abu and Udaipur

The students of the UN course in Space and Atmospheric Science went on a scientific tour to Mt Abu and Udaipur during 10-15 February. At Mt Abu Observatory, the students learned about the functioning of 1.2 m telescope and the back-end instrumentation. They observed the disk of Mars and the craters on the moon through the telescope. They also visited the LIDAR facility to know about its working principle and application. At Udaipur Solar Observatory (USO), they visited the site of

Global Oscillation Network Group (GONG) which is part of a global network to make continuous observations of the Sun. They got exposure regarding the working of the GONG instrument and the data products from the GONG. When in USO, it is a must to visit MAST, the Multi-Application Solar Telescope installed on the island in Lake Fatehsagar to observe the photospheric and chromospheric layers of the sun. The working principle and design of the main telescope and the imaging instruments were explained to the students. The adaptive optics system, developed in-house, for compensating atmospheric seeing was also shown and explained. Live solar images obtained by MAST were shown

to the students during the MAST visit.



One day Training on “Intel Compiler & VTune Performance Analyzer” for HPC Users



PRL Computer Centre, in coordination with M/s. Tata Consultancy Services (TCS) and Intel organized one-day training programme on Intel Compiler and Vtune Analyzer for High Performance Cluster (HPC) computer users. Dr. Namit Mahajan welcomed all the participants, briefed about the training program and introduced the speaker Ms. Naina Patil and Mr. Austin Cherian from Intel, Bengaluru. 40 PRL users participated in this programme. During the training, HPC users were informed about the Intel Compiler, optimization switches and Vtune Performance Profiler for application performance analysis on the HPC. Mr. Jigar Raval also co-related the Intel compilers and tools with the Vikram-100 HPC facility during the session. An important highlight of the session was a brief introductory session on AI technologies from Intel. The session, being interactive in nature, led to a lot of discussions, and turned out to be very informative and helpful for HPC users.

Scientific Tour to Narara Marine Park, Porbander and Dwarka

Staff Welfare Committee (SWC) conducted a Scientific Tour to Narara Marine National Park Vadinar, Porbander and Dwarka during 2 – 3, February' 2019. About 110 staff members and their families were a part of this tour. The group visited the Narara Marine National Park, famous for its rich marine ecosystem - enriched with numerous organisms like sea weeds, octopus, puffer fish, stingray, sea stars, sea-cucumber, corals, anemones, crabs etc. They visited the Kirti Mandir, a memorial built in memory of Mahatma Gandhi and Kasturba Gandhi, Porbandar and the Dwarkadhish



Visit to Mount Abu Astronomical Observatory (MIRO)

Ten students & three faculty members of PTS College of Science, Surat visited the 1.2 m Infrared Telescope on 14th February 2019. They got familiar with the various scientific observations carried out at observatory. They were also explained about the working of various instruments, data recording & control systems of telescope.



International Day of Women and Girls in Science celebrated in Udaipur Solar Observatory

On the occasion of the International Day of Women and Girls in Science, an all-women team of USO visited Heritage Girls School, an all-girls residential school, about 20 km from Udaipur City. The program included talks on “The International Day of Women and Girls in Science” by Prof. Nandita Srivastava, “Introduction to Our Star: the Sun” by Ms. Sangeeta Nayak, “Women's contribution to Science and Technology Development” by Ms. Bireddy Ramya, “How to become a Scientist: career opportunities for research” by Ms. Kamlesh Bora. A poster was presented by Ms. Anisha Kulhari on Few Women Scientists as well as facts and statistics of the participation of women in Science. Presentations

were also made by school children in nine presentations on two topics which were given by the school children – Efforts to Enhance the Contribution of Women in Science (Class XI & XII), and Space Exploration Benefits our world (Class IX and X). The best presentation from each category was awarded.



Awards and Honors

- ✚ **M.M. Sarin**, Honorary Scientist, Geosciences Division, has been awarded the Distinguished Fellowship of the Science & Engineering Research Board-DST (SERB).
- ✚ **Nandita Kumari, Harish Nandal and Vijayan S** from Planetary Sciences Division, have won the **Best Poster award** for the paper titled “*Complex Craters Within Lunar Basin and Their Implication*” in the 20th National Space Science Symposium held in Savitribai Phule Pune University during 29 January 2019 to 31 January 2019.

Hearty Congratulations to all the colleagues conferred with these awards and honours !

- + **Anil Bhardwaj** (Director, Physical Research Laboratory, Ahmedabad) gave the PRL–IAPT Dr. Vikram Sarabhai Lecture-2019, on the topic “*Indian Planetary Missions*”, on 07 February 2019.
- + **Shailesh Nayak** (Director, National Institute of Advanced Studies, Bengaluru and Chancellor of the TERI School of Advanced Studies), gave a Special Colloquium with the title “*Environmental Changes and Future Earth: An Indian Perspective*” on 8 February 2019.
- + **Hermann W. Bange** (Head of Research Group “Trace Gas Biogeochemistry”, GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany), gave a Special Colloquium with the title “*Non-CO2 Trace Gases in the Ocean*”, on 18 February 2019.
- + **N. Purnachandra Rao** (Director, National Centre for Earth Science Studies, Ministry of Earth Sciences, Thiruvananthapuram), gave a Special Colloquium with the title “*Earthquakes and Tsunamis in the Indian Subcontinent*” on 19 February 2019.

The Editorial Team



Bijaya Sahoo



Partha Konar



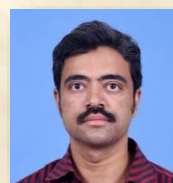
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Deekshya Sarkar



Prashant Jangid



Neeraj Srivastava



Pragya Pandey



Som Sharma



Vivek Mishra



Rohan Louis



Garima Arora



Kartik Patel



Veeresh Singh

