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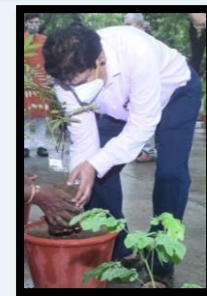
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# CELEBRATING THE 101<sup>ST</sup> BIRTH ANNIVERSARY OF DR. VIKRAM SARABHAI



The year 2019-2020 is the Birth Centenary of Dr. Vikram Sarabhai, the founder of PRL, and 12<sup>th</sup> August 2020 was his 101<sup>st</sup> Birth Anniversary. In the normal circumstances, PRL would have celebrated this momentous occasion with a great fervor, but due to COVID-19 pandemic situation, it was not possible. Therefore, PRL had organized a Webinar on “Dr. Vikram Sarabhai and Physical Research Laboratory (PRL)”, on Monday, 10 August, from 10:00 - 12:00 Hrs. Shri A.S. Kiran Kumar, Chairman, PRL Council of Management, was the Guest of Honour, of this Webinar. The two very learned speakers, Dr. K. Kasturirangan, Honorary Distinguished Advisor, ISRO, and Shri Kartikeya Sarabhai, Director, Centre for Environment Education; shared their reminiscences on “Dr. Vikram Sarabhai and PRL” based on their personal association with both Dr. Sarabhai and the PRL. The webinar was broadcasted on YouTube and PRL Facebook page, which was viewed by around 5000 persons.

The traditional event of garlanding the statue of Dr. Vikram Sarabhai at main campus and bust at Thaltej campus and tree plantation to commemorate Vikram Jayanti, 12 August 2020 was arranged. The event was arranged in the presence of a very limited number of PRL colleagues and Sarabhai family members by following the COVID-19 protocols, precautions, and social distancing. In view of the unprecedented situation, the event was recorded which was made available on the PRL website soon after the event. The event was also celebrated with great enthusiasm at the Udaipur Solar Observatory, keeping in view all the protocols and precautions.





# DEVELOPMENT OF A CONFINED CIRCULAR RIBBON FLARE AND ASSOCIATED PRE-FLARE ACTIVITY

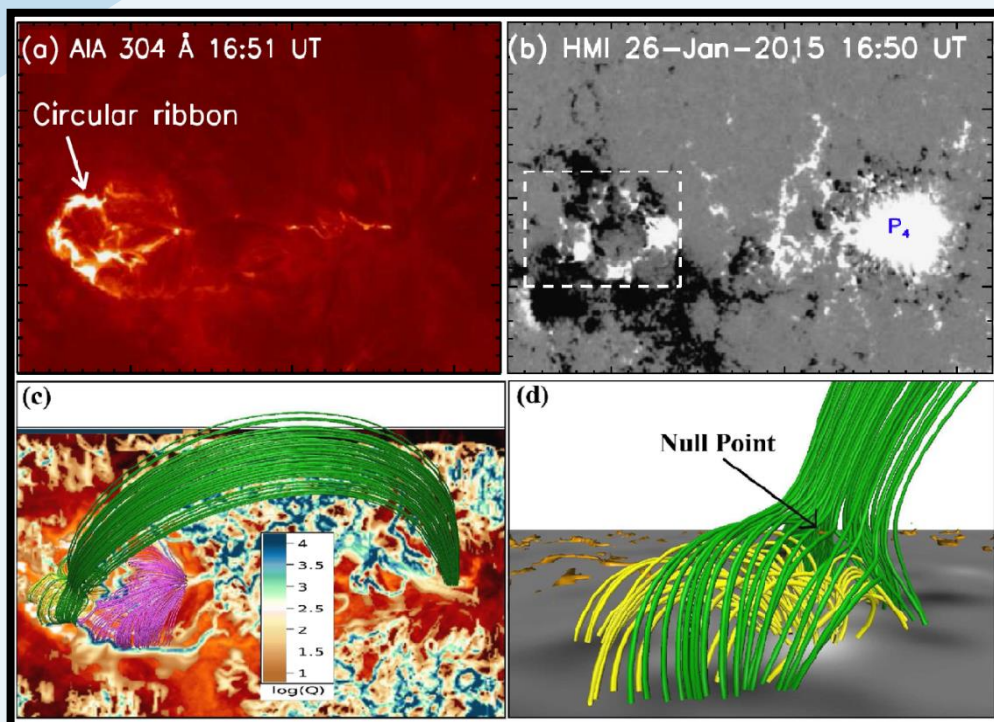
(Pooja Devi, Bhuwan Joshi, Ramesh Chandra, Prabir K. Mitra, Astrid M. Veronig, Reetika Joshi)



PRABIR MITRA

Circular ribbon flares are among the most complex solar transient features that involve a fan-spine configuration containing a pre-existing coronal null point. Such a magnetic configuration can develop in anemone type photospheric magnetic configurations where a single polarity is surrounded by opposite polarity in a circular pattern. In this work, we present an exquisite circular ribbon flare of GOES class M1.1 (Figure 1(a)) originating from an anemone type active region (Figure 1(b)) and related pre-flare activity that occurred on 26 January 2015 in the solar active region NOAA 12268. Our observations suggest that the pre-flare activity in the active region started  $\approx 15$  min prior to the main flare in the form of localized bright patches at two locations. Non-linear Force Free Field modeling of the coronal magnetic field revealed the presence of a fan-spine magnetic configuration involving a coronal null-point (Figures 1(c)-(d)). The location of the circular ribbon and the remote brightening were exactly co-spatial with the footpoints of the fan-lines and the outer spine lines, respectively, which provides strong evidence of null-point reconnection as responsible for the occurrence of the circular ribbon flare. Further, the remote brightening was observed to display an apparent motion towards west during the flare. The analysis of ‘quasi-separatrix layers (QSLs)’ suggest high values of the degree of squashing factor ( $Q$ ) at the region of remote brightening which explains the apparent motion in view of ‘slipping reconnection’.

<https://doi.org/10.1007/s11207-020-01642-y>



Panel (a): AIA 304 Å image showing the circular ribbon flare. Panel (b): Co-temporal LOS HMI magnetogram showing the magnetogram associated with the circular ribbon (indicated by the white dashed box) and the region of remote brightening (marked by P4). Panel (c): NLFFF extrapolation results showing a fan-spine configuration and distribution of  $\log(Q)$  over the background AIA 304 Å image. A close up of the fan region is shown in panel (d) where the location of the null-point is indicated by an arrow

# FIRST DETECTION OF HXR CORONAL CHANNEL EVIDENCING ACTIVATED MAGNETIC FLUX ROPE STRUCTURE IN SOLAR CORONA

(Suraj Sahu, Bhuwan Joshi, Prabir K. Mitra, Astrid M. Veronig, V. Yurchyshyn)

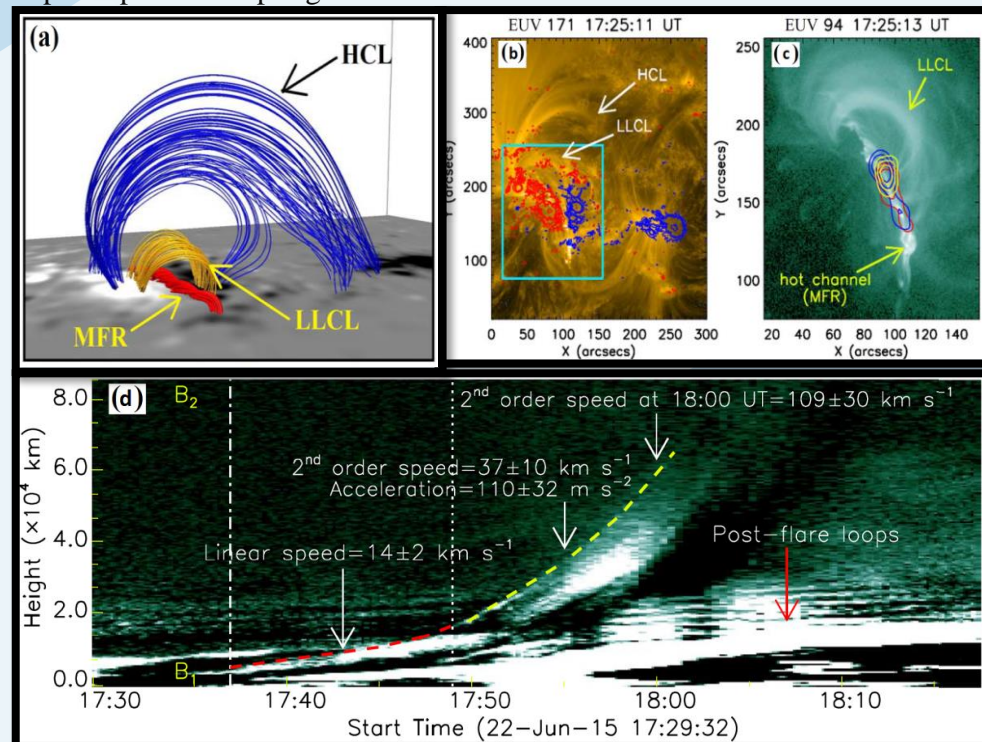


SURAJ SAHU

The conditions governing the formation and development of flux ropes is dependent upon the local coronal magnetic field topology and magnetic flux evolution through the photosphere below. To explore the underlying mechanisms in detail, we conduct a comprehensive multi-wavelength analysis of a major M6.6 long duration solar event with special emphasize on its pre-flare phase. The event occurred in active region NOAA 12371 on 2015 June 22. A remarkable aspect of the event was an active pre-flare phase lasting for about an hour during which a hot EUV coronal channel was in the build-up stage and displayed co-spatial hard X-ray (HXR) emission up to energies of 25 keV.

The coronal magnetic field configuration based on non-linear-force-free-field (NLFFF) modeling clearly exhibited a magnetic flux rope (MFR) oriented along the polarity inversion line (PIL) (Figure 1(a)) and co-spatial with the HXR coronal channel (see Figure 1(c)). This is the first detection of an MFR through direct HXR imaging, signifying the MFR to be in the hot, activated stage. We observed significant changes in the active region's photospheric magnetic field during an extended period of  $\approx 42$  hr in the form of rotation of sunspots, moving magnetic features, and flux cancellation along the PIL. Prior to the flare onset, the MFR underwent a slow rise phase ( $\approx 14$  km/s) for  $\approx 12$  minutes, which we attribute to the faster build-up and activation of the MFR by tether-cutting reconnection occurring at multiple locations along the MFR itself. The sudden transition in the kinematic evolution of the MFR from the phase of slow to fast rise ( $\approx 109$  km/s with acceleration  $\approx 110$  m/s<sup>2</sup>) precisely divides the pre-flare and impulsive phase of the flare, which points toward the feedback process between the early dynamics of the eruption and the strength of the flare magnetic reconnection.

<https://iopscience.iop.org/article/10.3847/1538-4357/ab962b>



Panel (a) – NLFFF modeling of the active region corona reveals the existence of magnetic flux rope (MFR), low-lying coronal loops (LLCL), and high-lying coronal loops (HCL) in the flaring region. Panel (b) – EUV 171 Å image of the active region during the pre-flare phase, overplotted with the photospheric line-of-sight magnetogram with blue/red contours corresponding to negative/positive polarities. Panel (c) – EUV 94 Å channel image for the smaller FOV in panel (b) with X-ray contours in 5–10 keV (red), 10–15 keV (blue), and 15–25 keV (yellow). Panel (d) – Time-slice diagram of the erupting hot channel shows the slow rise phase between  $\approx 17:37$  UT and  $\approx 17:49$  UT (shown by the red dashed line), which is followed by another phase of its fast eruption (shown by yellow dashed line) between  $\approx 17:49$  UT to  $\approx 18:00$  UT.



# STICKING DUST AND MICROMETEORITE PARTICLES ONTO ICES AT HIGH IMPACT VELOCITIES - IMPLICATIONS FOR ASTROCHEMICAL ICE ENRICHMENT

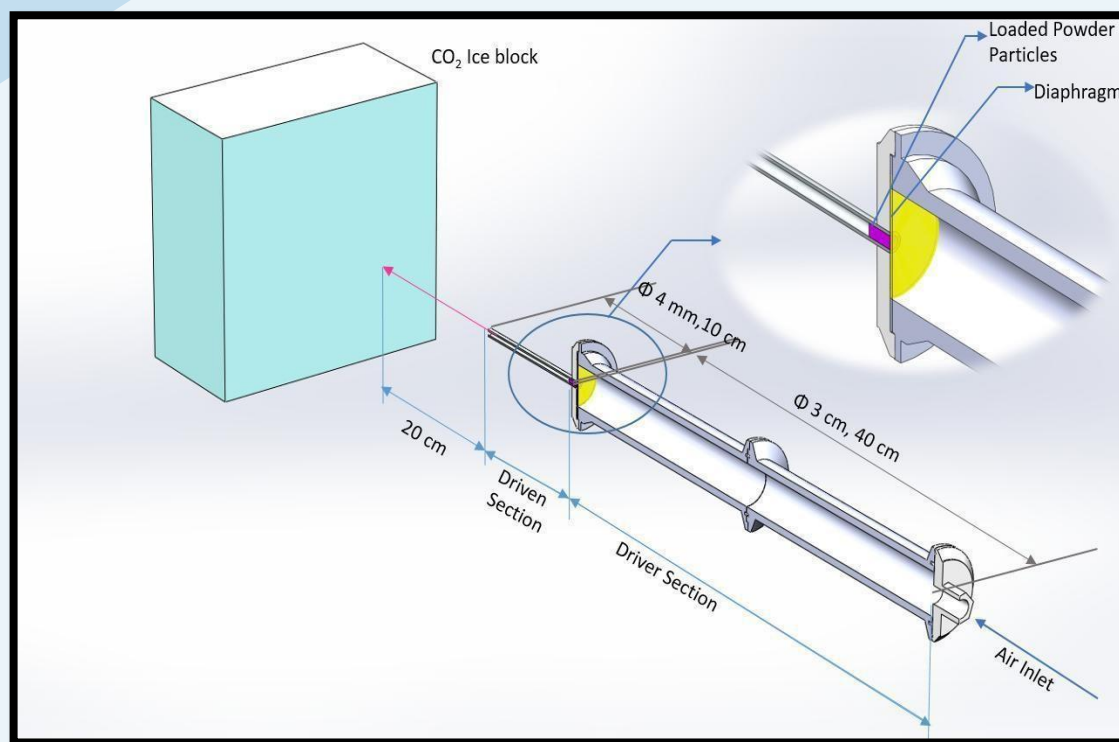
(E. Shivakarhik, J.K.Meka, Harish, V.S. Surendra, K.K.Rahul, R.Thombre, H.Hill, S.Vijayan, B. Sivaraman)



JAYA KRISHNA  
MEKA

Impact events are inevitable to date both within the inner and outer regions of the Solar System. Such impact events dominate the surface modifications of most of the airless bodies. Regardless of the destructive nature of impact events, the birth of few moons in the Solar System are known to be the by-product of impacts. Moreover, particle aggregation from relatively low velocity impacts (from nm to  $\mu\text{m}$  sized dust particles) are thought to be the reason behind the growth of planetesimals. While considering impact events in the colder regions of the Solar System the role of molecular ices in planetesimal aggregation cannot be neglected. Therefore, to understand the role of such small particle impacts over icy bodies, we investigated the sticking of dust particles on to ices in the higher velocity impact regime,  $100\text{--}300\text{ m s}^{-1}$ , using a modified hand-driven shock tube (Reddy Tube). Grains of brick, basalt and powdered turmeric, graphite and fullerene soot particles were fired on to the  $\text{CO}_2$  ice targets. Meteorite samples (Sulagiri and Allende) were used to mimic the real micrometeorite impacts on dry ice. The particles of different sizes and impact angles are found to significantly affect the sticking pattern. The impact area was observed to be coated by the impacting material. Lesser micron-sized particles were observed to penetrate the ice layers and the larger ones eroding them. Results suggest that astrochemical ices can be chemically enriched by high velocity dust/micrometeoroid impacts.

**Source/Reference:** <https://doi.org/10.1016/j.pss.2020.104972>



Schematic of the modified gas driven tube used for propelling multiple projectiles onto the dry ice target. The schematic shows an impacting angle of  $90^\circ$  to the ice surface



# INDEPENDENCE DAY - 2020 CELEBRATIONS @ PRL



The 74th Independence Day was celebrated with the hoisting of the National Flag by Dr. Anil Bhardwaj, Director, PRL at 10.00 hrs. near library lawns of PRL Main Campus. Due to present condition of COVID-19 pandemic and the MHA Guidelines, the Independence Day was celebrated following the protocols, precautions & social distancing measures with the restriction of 50 PRL Members. The event saw an inspiring speech by the Director, PRL. Exceptionally good CISF personnel were awarded for their services. The entire function was telecast live on the YouTube for all the staff members. The event was also celebrated at Udaipur Solar Observatory keeping in view all the social distancing norms.



## AWARDS AND HONOURS

- **Srubabati Goswami**, (Senior Professor, THEPH) has been awarded the *J. C. Bose Fellowship*.
- **Shyam Lal**, (Honorary Faculty) has been awarded the *K. R. Ramanathan Medal (2020)* by the Indian National Science Academy.

WE HEARTILY CONGRATULATE THE COLLEAGUES CONFERRED WITH THESE AWARDS AND HONOURS !

## SUPERANNUATION



GANESH KOTIAN

Shri Ganesh Kotian, Canteen Supervisor (Cook), superannuated from PRL on 31/8/2020 after serving the institute for nearly 34 years. PRL family thanks him for his contributions towards the betterment of the institute and wishes him a happy and healthy superannuated life.

## HEARTY WELCOME TO NEW MEMBERS



AVADH KUMAR

SCIENTIFIC ASSISTANT



ROHIT MEENA

SCIENTIFIC ASSISTANT



DISHENDRA

SCIENTIFIC ASSISTANT



SANKETBHAJI PATEL

SCIENTIFIC ASSISTANT



# OBITUARY



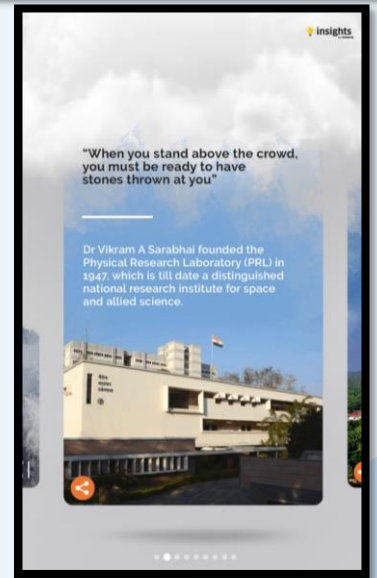
<b>Late Shri V.C. Gajjar</b>	
<b>Senior Technician-A</b>	
<b>Date of Birth</b>	20.10.1941
<b>Date of retirement</b>	31.10.2001
<b>Date of Death</b>	16.08.2020

We mourn the demise of our former employee and fondly remember his contributions to PRL. We pray for the well-being of his bereaved family. May his soul rest in peace.

# PRL IN NEWS



Popular news mobile application “Inshorts” paid tribute to Dr. Vikram Sarabhai on his birth anniversary and featured PRL in one of the images. Here are a few screenshots from the app paying tribute to Dr. Sarabhai, the founder of PRL and the Indian Space Program.



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