



### The Author



Jayesh  
Pabari

#### About him:

Dr. Jayesh Pabari received his Ph. D. from Indian Institute of Technology, Bombay. His research fields are planetary sciences. His research focus is on study of interplanetary dust in the inner solar system, understanding of planetary dust and study of planetary lightning; through modelling and data analysis.

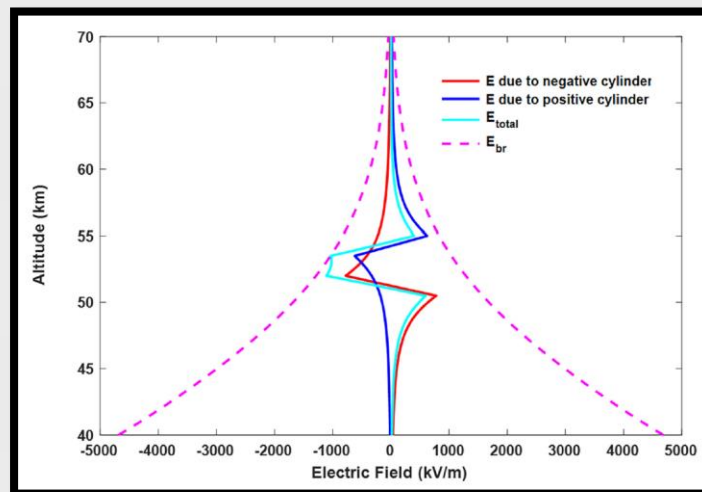


### Venus Lightning: Estimation of Charge and Dimensions of Charge Regions for Lightning Initiation

(V. R. Dinesh Kumar, Jayesh P. Pabari, Kinsuk Acharyya, C. T. Russell)

The occurrence of Venusian lightning must be preceded by electrification of particles in Venusian clouds and separation of these charged particles to form distinct charged regions. In this work, we estimate the minimum required charge and the dimensions of these charge regions in order for lightning to occur. The expected streamer speed in Venusian middle clouds is on the order of  $10^5$ – $10^6$  m/s. The charged region in Venus's middle clouds has been approximated as uniformly charged cylinders. The radius, thickness, and charge density of the charged region have been estimated to be about 1–20 km, 1–3 km, and  $1$ – $28$  nC/m<sup>3</sup>, respectively. The lack of global magnetic fields on Venus has resulted in the formation of weak induced magnetic fields that give unrestricted access to Galactic Cosmic Rays (GCR). The ionization of the lower atmosphere of Venus due to GCR has been a subject of many earlier studies, and it has been considered a source for cloud electrification on Venus. The fields produced by charged regions with charge density levels from GCR-induced ionization do not exceed breakdown fields. The required levels of charge density could be produced by collisional charging.

( Ref: <https://doi.org/10.1016/j.icarus.2021.114473> )



**Figure:** Typical profile of effective electric fields in the Venusian clouds. The total electric potential is found to be on the order of  $\sim 10^9$  V and the capacitance of the configuration is  $\sim 166$  nF. The electrostatic potential energy stored within this charge configuration is on the order of  $\sim 10^{11}$  J, a large portion of which is distributed to RF and optical energies of the discharge.

### What's Inside ?

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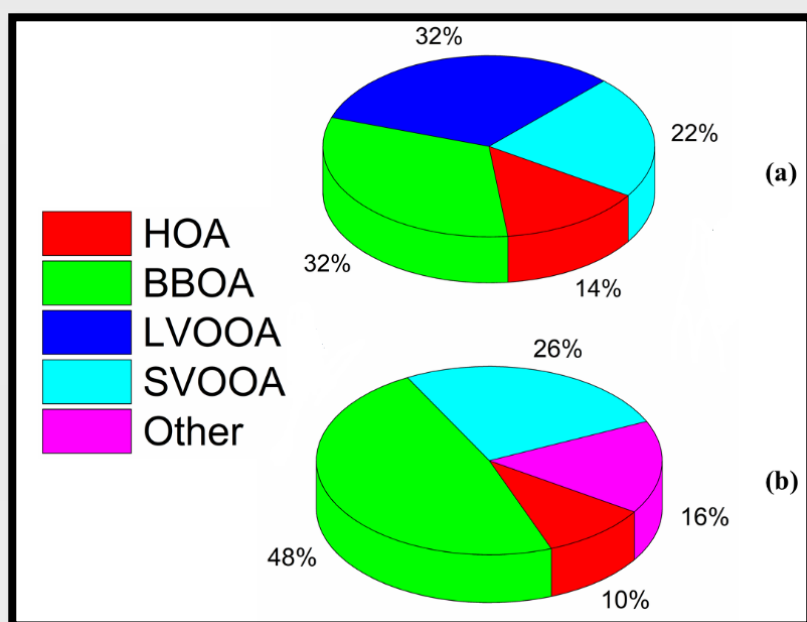
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## Sources and Characteristics of Light-Absorbing Fine Particulates Over Delhi Through the Synergy of Real-Time Optical and Chemical Measurements

(Atinderpal Singh, Neeraj Rastogi, Varun Kumar, Jay G. Slowik, R. Satish, Vipul Lalchandani, Navaneeth M. Thamban, Pragati Rai, Deepika Bhattu, Pawan Vats, Dilip Ganguly, S.N. Tripathi, André S.H. Prévôt)

Present study examines the light absorption characteristics of fine atmospheric particulates (PM<sub>1</sub>) using the co-located real-time measurements of chemical and optical aerosol characteristics at a site located in Delhi (28.54°N, 77.19°E) during winter (January 01 to February 10, 2019). The contribution of absorption by BC and BrC to the total absorption ( $b_{abs}$ ) is computed using the absorption Ångström exponent (AAE) method. The period average contribution of BrC absorption ( $b_{abs\_BrC}$ ) to  $b_{abs}$  is found to be highest at 370 nm (23%) that decreased exponentially with increasing wavelengths, i.e., 18, 12, 10, and 4% at 470, 520, 590, and 660 nm, respectively. The absorption spectrum of BrC is used to study the bulk composition of BrC, which indicates that primary BrC was dominant during morning and night time, whereas secondary BrC was significant during the rest of the time. Further, organic aerosols (OA) were divided into different factors using positive-matrix factorization (PMF) analysis, and the mass absorption efficiency ( $E_{abs}$ ) of each factor was assessed through multivariate linear regression of  $b_{abs\_BrC}$  with OA factors. The biomass burning OA (BBOA) exhibited the highest  $E_{abs}$  at 370nm ( $0.86 \text{ m}^2 \text{ g}^{-1}$ ), followed by semi-volatile oxygenated OA (SVOOA;  $0.67 \text{ m}^2 \text{ g}^{-1}$ ) and hydrocarbon-like OA (HOA;  $0.42 \text{ m}^2 \text{ g}^{-1}$ ). Further, although the composition of OA was dominated by LVOOA (32%) and BBOA (32%), followed by SVOOA (22%), and HOA (14%) (Fig. a), their contribution to  $b_{BrC}$  followed different order due to differences in their mass absorption efficiencies. The BBOA contributed almost half (48%) of  $b_{abs\_BrC}$  followed by SVOOA (26%), and HOA (10%) (Fig. b). This study provides quantitative information on the sources of BrC and their relative contribution to BrC absorption over a heavily polluted region.

( Ref: <https://doi.org/10.1016/j.atmosenv.2021.118338> )



**Figure:** Relative contribution of organic aerosol (OA) component loadings (a) to OA mass and (b) to brown carbon absorption at 370 nm

## The Author



Atinderpal Singh

### About him:

Dr. Atinderpal Singh earned his PhD on 'Physical, Chemical, and Optical Properties of Aerosols' from Punjabi University, Patiala. Subsequently, he joined Geosciences Division, PRL as a postdoc, and did multiple field campaigns using High-Resolution Time-of-Flight Aerosol Mass Spectrometer to characterize fine organic aerosols over Ahmedabad and Delhi.



## The Author



Jay Dave

### About him:

Mr. Jay Dave did his M.Sc. in Chemistry from the Gujarat University. He worked as project scientific assistant in Geosciences Division. He did a year-long field campaign for the source apportionment of fine organic aerosols over Delhi, and a short-campaign to study the effect of lockdown on ambient aerosol composition over Ahmedabad.

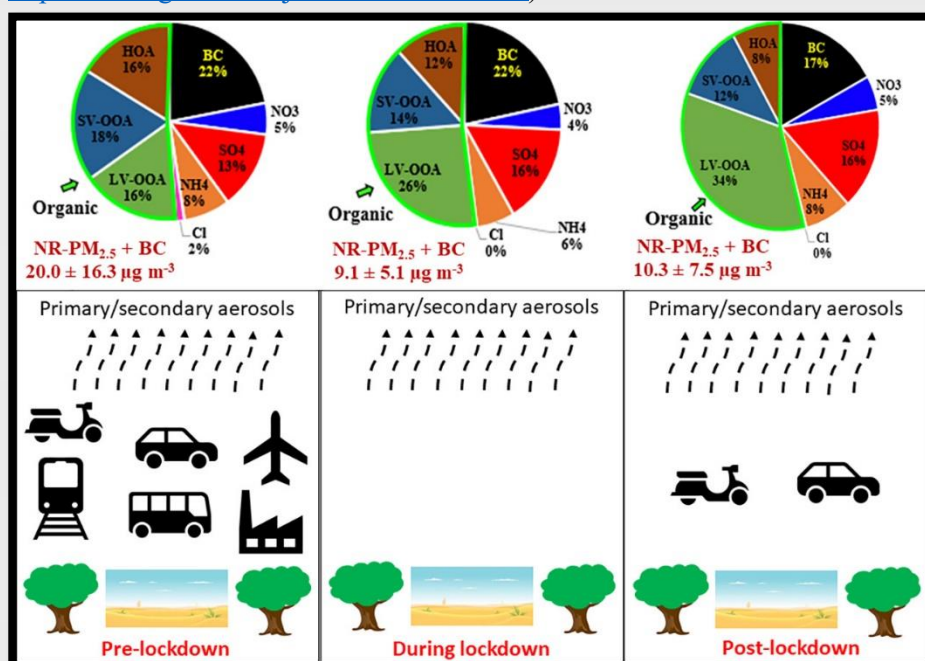


## Effect Of COVID-19 Lockdown on The Concentration and Composition of NR-PM<sub>2.5</sub> Over Ahmedabad, A Big City In Western India

(Jay Dave, Rohit Meena, Atinderpal Singh, and Neeraj Rastogi)

To investigate the impact of reduced anthropogenic emissions during the lockdown period on the concentration, composition, and characteristics of non-refractory particulate matter  $\leq 2.5 \mu\text{m}$  aerodynamic diameter (NR-PM<sub>2.5</sub>) and black carbon (BC) at Ahmedabad, a big city in western India, online measurements were performed from February 29 to March 23 (before lockdown, P1), April 10 to May 01 (during the lockdown, P2), and June 1 to June 16 (post lockdown, P3) using a high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) and an Aethalometer. In summary, the NR-PM<sub>2.5</sub> was dominated by OA during study period and on average, organic aerosols (OA), NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, NH<sub>4</sub><sup>+</sup>, Cl<sup>-</sup>, BC at 370 nm (BC<sub>370</sub>), and BC at 880 nm (BC<sub>880</sub>) were reduced by 52, 64, 43, 62, 86, 52, and 57%, respectively, during P2 compare to P1. However, the diurnal trends of species were similar during the lockdown and no-lockdown periods. Source apportionment of OA using positive matrix factorization analysis revealed three factors: hydrocarbon-like organic aerosol (HOA), low volatile oxygenated OA (LV-OOA), and semi-volatile oxygenated OA (SV-OOA), contributing 26%, 44% and, 30%, respectively, to the total OA during the study period. This study is essential in understanding and assessing the effects of reduced anthropogenic emissions on the air quality of Ahmedabad, which in turn shall be very useful in planning appropriate mitigation strategies. Atmospheric abundances and diurnal variability during lockdown, representing regional background concentrations, may also be very useful for regional modelling studies.

(Ref: <https://doi.org/10.1016/j.uclim.2021.100818>)



**Figure:** Average compositional pie chart of PM<sub>2.5</sub> species (NR-PM<sub>2.5</sub> plus black carbon (BC)) and each of the OA factors during P1 (before lockdown), P2 (during lockdown), and P3 (post-lockdown) periods.

## Invisible Neutrino Decay: First vs Second Oscillation Maximum

(Kaustav Chakraborty, Debajyoti Dutta, Srubabati Goswami, Dipyaman Pramanik)

*“Invisible threads are the strongest ties” - Friedrich Nietzsche*

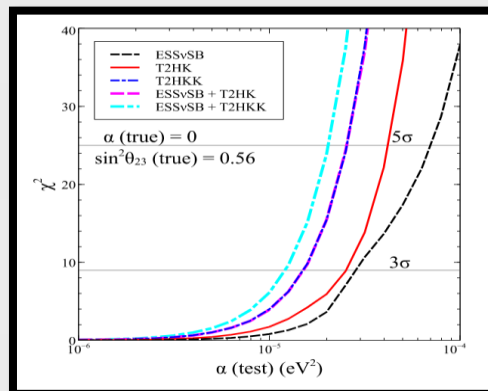
Neutrinos are the second most abundant particle in the universe, next only to photons. Yet, they are one of the most mysterious particles in the Standard Model because they are some of the least interactive ones. The Standard Model consists of three types (known as flavours) of neutrinos, electron neutrino, muon neutrino and tau neutrino. When neutrinos propagate, they oscillate between these three flavours; this phenomenon is known as neutrino oscillations. This happens because each neutrino flavour eigenstate is a superposition of three mass eigenstates. The observation of neutrino oscillation has established that neutrinos have mass.

Presently, neutrino oscillation physics has entered the precision era, and the potential forthcoming experiments Hyper-Kamiokande(T2HK/T2HKK), The European Spallation Source  $\nu$ -Beam (ESS $\nu$ SB) project are expected to strengthen this endeavour in the future. These experiments being very high statistics experiments also unravels the possibilities of studying various beyond the Standard Model scenarios. One such scenario is the premise of neutrino decay which is motivated by the fact that neutrinos have mass.

In this article, the study is based on neutrinos following normal hierarchy which results in  $\nu_3$  being the heaviest and  $\nu_1$  the lightest. We assume the state  $\nu_3$  as unstable, decaying into sterile states which are undetectable and obtain constraints on the neutrino decay lifetime ( $\tau_3$ ). We study the physics potential of the long-baseline experiments T2HK, T2HKK and ESS $\nu$ SB in the context of invisible neutrino decay. The measurable quantity in the neutrino oscillation experiments is the probability of neutrino oscillation from one flavour to the other. The long-baseline neutrino oscillation experiments are designed to explore the oscillation channel of muon neutrino converting to electron neutrino ( $P_{\mu e}$ ) as well as the probability of the survival of muon neutrino in the same flavour state ( $P_{\mu\mu}$ ). The first and second peaks of  $P_{\mu e}$  are known as the respective oscillation maxima. We compared and contrasted the sensitivities to decay of these experiments with special emphasis on the location of the experiments at first and second oscillation maximum and the various factors that can affect the sensitivities. T2HK is an experiment at the first oscillation maxima, ESS $\nu$ SB at the second oscillation maxima, while T2HKK is a hybrid setup combining both the oscillation maximum. We found that, overall, the combination of first and second oscillation maxima is best for the sensitivity to neutrino decay. Additionally, we observed that the neutrino mixing angle  $\theta_{23}$  directly influences the sensitivity to neutrino decay. Our study also underscores the importance of the  $P_{\mu\mu}$  channel in giving enhanced sensitivity to determine the octant of  $\theta_{23}$  for second oscillation maxima experiments in the presence of decay and the importance of better energy resolution in obtaining a higher sensitivity to decay.

(Ref: [10.1007/JHEP05\(2021\)091](https://arxiv.org/abs/10.1007/JHEP05(2021)091))

**Figure:** The  $\chi^2$  as a function of  $\alpha$  (decay parameter  $\sim 1/\tau_3$ ) for various combination of experiments.



## The Author



**Kaustav Chakraborty**

### About him:

*Dr. Kaustav Chakraborty is a Post-Doctoral fellow in PRL. He is currently working on the field of neutrino physics with special emphasis on exploring beyond the Standard Model scenarios in present and future neutrino oscillation experiments.*



## The Author



Dayanand  
Mishra

### About him:

Mr. Dayanand Mishra is a third year PhD student at PRL in the Theoretical Physics division. His study includes the behaviour of soft photons and their impact on heavy Meson decays.



Figure: (a) and (b) show the corrections in electron and muon mode, respectively. (c) show the correction in the observable  $R_K^{\mu e}$

## Impact of Soft Photons on $B \rightarrow K \ell + \ell^-$

(Dayanand Mishra and Namit Mahajan)

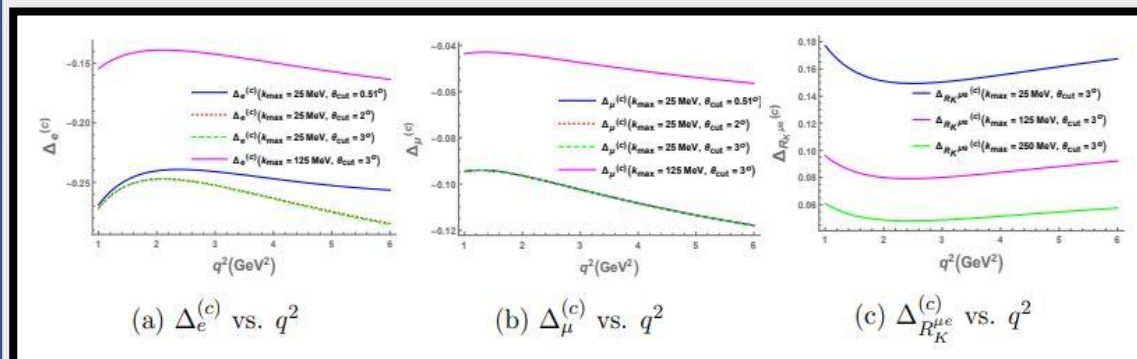
Nature, we believe, is described by four fundamental interactions, namely strong, weak, electromagnetic and gravitational. The Standard Model (SM) of particle physics incorporates theory of strong interactions and electroweak interactions (combination of electromagnetic and weak interactions). Although quite successful, SM has some shortcomings and is unable to explain certain experimental observations. Whether these indications are pointing towards a bigger theory or there are some not yet calculated/understood pieces within SM itself, or more data is needed on the experimental side, it is imperative to test SM predictions to better and better accuracy.

Since the quarks and gluons, which make up the hadrons (nucleons, pions etc.) are never observed as free particles, any physical process requires the calculations in terms of these bound states rather than free quarks and gluons. It is these bound state effects that bring in the largest source of theoretical uncertainty. One possible way out is to consider quantities that are least sensitive to such effects. The decay of beauty quark to strange quark and lepton pair ( $e^+ e^-$  or  $\mu^+ \mu^-$ ) is a neutral current weak decay (net charge of the leptons is zero) gives rise to physical processes like  $B \rightarrow K \ell^+ \ell^-$ , where B and K are mesons like pions. The ratio of decay rates into muon pair to electron pair,  $R_K^{\mu e}$ , in such a process presents an observable that is essentially insensitive to bound state effects. SM predicts its value to be unity with very small errors while experimentally lower value is measured. Is this a sign of physics beyond SM? Or some new bound state effects are at work? Staring a bit at the process, since there are charged particles involved, the electromagnetic (Quantum Electrodynamics or QED) corrections could be important. Experimentally, a charged particle say an electron is indistinguishable from an electron and a photon if the photon energy is lower than the detector resolution. Theoretically, these two are processes with different final states and thus need to be added incoherently, i.e. at the level of rate rather than amplitude level as is dictated by the superposition principle of quantum mechanics. This incoherent addition also removes the infrared divergence due to the emission of soft photons (related to the infrared catastrophe of classical electrodynamics).

We carefully compute these corrections and find that the dominant contribution is of the form  $\log(m_\ell)$ , called collinear logarithms. The electron modes are thus going to be affected about three times compared to muon modes for the typical photon energy resolution chosen. However, once the chosen resolution energy is larger than the muon mass, both the modes are affected in a similar manner. The QED corrections are found to be negative and thus decrease the rates, while for reasonable choice of photon energy resolution, the ratio  $R_K^{\mu e}$  can be made almost completely insensitive to QED effects. The shift induced due to the QED corrections to different modes is clearly visible in the graph (for a specific choice of photon energy cut).

This then provides a sound basis to the theoretical predictions and suggests ways to implement experimental cuts on energies and angles such that a very clean observable is at hand. Such QED effects are going to be important for many other processes and observables and point to an immediate need to be incorporated carefully before comparing with the experimental numbers and drawing any conclusions.

(Ref: [Phys.Rev.D 103 \(2021\) 5, 056022](https://arxiv.org/abs/2105.05602))



## X-ray Properties of New Black Hole X-ray Binary MAXI J0637-430

(Arghajit Jana, Gaurava K. Jaisawal, Sachindra Naik, Neeraj Kumari, Birendra Chhotaray, Diego Altamirano, R. A. Remillard, Keith C. Gendreau)

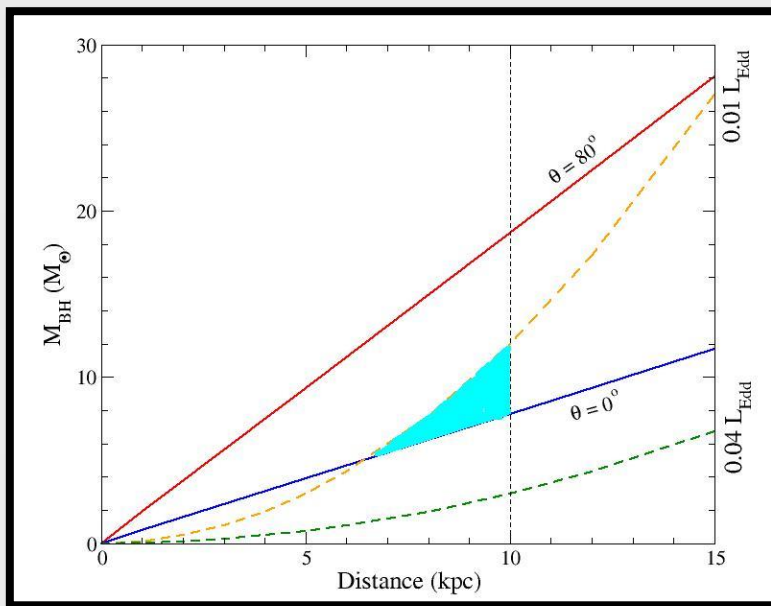
On November 2<sup>nd</sup>, 2019, a new X-ray source was detected by Japanese X-ray detector MAXI, on-board International Space Station (ISS). The new X-ray source was named MAXI J0637-430 after its location at the sky and MAXI. Soon after the discovery, X-ray detector NICER and X-ray satellite Swift started monitoring the source on a regular basis. On November 6<sup>th</sup>, 2019, the source reached its peak with 0.5-10 keV X-ray flux of  $9 \times 10^{-9}$  ergs/cm<sup>2</sup>/s. The source was active for ~ 6 months.

In general, X-ray sources are the binary system, containing a normal/evolved star and a compact object - a neutron star or a black hole. A major puzzle of X-ray transient source is to determine the nature of the compact object. Measurement of the mass of the compact object is only firm way to conclude the nature. A neutron star can have a maximum mass of 3 Solar mass (3 times mass of Sun). For a black hole, mass would be greater than 3 Solar mass.

The nature of the compact object was unknown. Thus, we investigated the nature of the compact object using the data obtained by NICER and Swift. Based on the study of the timing and spectral properties of the source, we concluded that the compact object is likely to be a black hole.

We found that the source consists of an evolving accretion disk. The disk temperature was ~0.6 keV when the X-ray intensity was maximum. Later, the disk cooled, hence the X-ray flux decreased. Remarkably, the disk flux followed T4-law in the high flux state. In the low flux states, the disk was not detected. Assuming the black hole to be non-rotating, we estimated the mass of the black hole is likely to be in the range of 5-12 Solar mass if it is located  $d < 10$  kpc.

(Ref: [10.1093/mnras/stab1231](https://doi.org/10.1093/mnras/stab1231))



**Figure:** Mass–distance relation for MAXI J0637–430 is plotted assuming a non-rotating black hole. The mass of the BH lies in the shaded region.

## The Author



Arghajit  
Jana

### About him:

Dr. Arghajit Jana is a Post-Doctoral Fellow in Astronomy & Astrophysics Division at PRL. He received his PhD in from the Indian Centre for Space Physics for research on black hole X-ray binary. His research topic includes understanding the properties of black hole binaries and Active Galactic Nuclei (AGN). He studies the accretion dynamics, evolution and disk-jet connection of black hole and active galactic nuclei from X-ray observations.



## The Author



Bhalamurugan  
Sivaraman

### About him:

Dr. Bhalamurugan Sivaraman is an experimental astrochemist with a PhD from The Open University, UK. His research in astrochemistry to understand the Physico-chemical nature of astromolecules ranges from the low-temperature icy mantles to high-temperature processes.



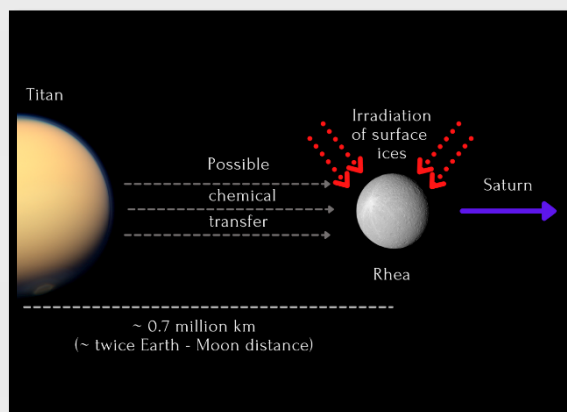
## Possible Detection of Hydrazine on Saturn's Moon Rhea

(Mark Elowitz, Bhalamurugan Sivaraman, Amanda Hendrix, Jen-Iu Lo, Sheng-Lung Chou, Bing-Ming Cheng, B N Raja Sekhar, Nigel J Mason)

We present the first analysis of far-ultraviolet reflectance spectra of regions on Rhea's leading and trailing hemispheres collected by the Cassini Ultraviolet Imaging Spectrograph during targeted flybys. In particular, we aim to explain the unidentified broad absorption feature centred near 184 nm. We have used laboratory measurements of the UV spectroscopy of a set of candidate molecules and found a good fit to Rhea's spectra with both hydrazine monohydrate and several chlorine-containing molecules. Given the radiation-dominated chemistry on the surface of icy satellites embedded within their planets' magnetospheres, hydrazine monohydrate is argued to be the most plausible candidate for explaining the absorption feature at 184 nm. Hydrazine was also used as a propellant in Cassini's thrusters, but the thrusters were not used during icy satellite flybys and thus the signal is believed to not arise from spacecraft fuel. We discuss how hydrazine monohydrate may be chemically produced on icy surfaces.

This work reveals the curious connection between the Saturnian moons Titan and Rhea.

(Ref: <https://doi.org/10.1126/sciadv.aba5749> )



**Figure:** Possible exogenous delivery of hydrazine or its precursors from Titan to Rhea and in-situ synthesis of hydrazine via irradiation of the surface ices.

## Events & Activities

As per the Department of Space, Government of India directives, 21<sup>st</sup> May is to be observed as 'Anti-Terrorism Day'. Anti-Terrorism Pledge was taken by all the employees solemnly at their respective work place amidst Covid-19 pandemic restrictions in PRL.

## My Interaction with COVID-19

- Anil Shukla



Anil D. Shukla  
Associate Professor  
Geosciences Division

It started on the morning of April 11, 2021, after breakfast, at around 11:00AM I noticed that my body temperature was a little higher (99.6°F). I took a paracetamol tablet and isolated myself. This happened around 10 days after I had the 1st dose of Covishield Vaccine.

After isolating myself, I started monitoring my symptoms. I couldn't rule out the possibility of having common flu at that point of time. I started some low dose generic antibiotics as well as paracetamol tablets for fever. I communicated my condition to PRL medical officer, Dr. Dani, on Tuesday 13, April 2021, and went for RT-PCR and other tests. For that purpose, I went immediately with Deepti (wife) to VIP lab on Judges Bungalow road and on return, I found my body temperature was 103°F. The temperature did not go below 101°F even after consuming paracetamol and hence I took combiflam which brought it below 100°F. My RT-PCR COVID positive report came around 5:00PM on 14<sup>th</sup> April 2021 and my focus shifted to my family for getting tested for COVID. I started my COVID medication, as suggested by Dr. Dani, from 14<sup>th</sup> April evening. On 15<sup>th</sup> April, I noticed that my wife was showing some symptoms of fever and flu and then in consultation with Dr.

Dani, COVID medication for her also started in the early morning of 15<sup>th</sup> April. Medications for the kids also got started at that point as it was taking time for the COVID test results to come due to heavy load on the testing machinery. Their samples for RT-PCR test were collected in the afternoon of 15<sup>th</sup> April and the COVID positive confirmations reached us in the afternoon of 16<sup>th</sup> April 2021.

After becoming COVID positive I started to follow my oxygen level (SpO<sub>2</sub>) using Oximeter from 14<sup>th</sup> April onward. It went below 90 on some occasions but I was not very worried at that point as I was expecting SpO<sub>2</sub> between 80-100. This matter was discussed with one of my relative (Doctor) who advised me to make a record at regular intervals with 3 to 4 observations. My real problem started in the late afternoon of April 17, and I also experienced slight chest pain with my Oxygen level dropping below 90. My talks with my wife and kids were very erratic at that point. My wife Deepti called my friend Dipu, who arranged a private ambulance, for which I opposed, as I felt I was fine. Fortunately, I agreed with the suggestion of Doctor, to take oxygen from the ambulance set-up. I overheard discussion and helplessness of people around me and over phone regarding which hospital to go at this moment as getting an ICU Oxygen bed was extremely difficult. I kept on insisting that I did not require hospitalization and we could approach hospitals if need arose. Here I would like to add that in my mind I thought that if I needed hospitalization, I might arrange facilities at home as I was aware that these facilities were provided by the private Hospitals like Shalby, which I could not discuss with my family. On 17<sup>th</sup> April night my talking was not consistent and I spoke erratically that further increased the level of concern about my health. On the morning of 18<sup>th</sup> April, my family contacted Dipu, who has booked the private ambulance but he and his family kept on trying and booked the 108 ambulance service with a waiting time of 9-10 hours. His daughter Ayushi was able to get through the service of 108 as for hospital admission, one had to approach through 108 at that time due to prevailing rules and regulation. Since it was not clear when it would arrive, private ambulance was again contacted and kept on the call. Unfortunately, due to heavy demand, private ambulance was not immediately available at that time. It seems a decision was made at that time to take the ambulance, private or 108 service, whichever comes first as that would arrest the possible O<sub>2</sub> level drops in my body. My family said they observed my oxygen level below 70 and my fingers were becoming blue. Even in this situation I was still arguing that I was all right and trying to force them not to call anyone. Fortunately, although the private ambulance didn't arrive, they did send Dr. Sachin and although he was without any equipment's, his presence was crucial at that critical moment. Eventually and fortunately, 108 ICU ambulance arrived around 2 PM and I was taken to Shiv Hospital in Bakrol, Ahmedabad which is AMC listed private Covid hospital, based on the availability of the ICU bed. I felt better when I was given O<sub>2</sub> in the ambulance although I was still vehemently resisting my wife who accompanied me in the ambulance. I was also shouting at the ambulance staff against my hospitalization. This is what COVID can do. I realize this now and feel bad for my behavior at that point of time. It seems that I was not in senses. It appears that the Dr. Satyam at the Shiv Hospital was not comfortable treating me as he probably felt that it required a different set of medical strategies wherein the possible impact of COVID on my psychological state was also addressed. However, my friends from different spheres could convince him to initiate and continue the treatment there as it was difficult at that time to get an ICU oxygen bed in a hospital.

After seeing my brother Anoop on 19<sup>th</sup> April 2021 morning, I felt relieved and my focus changed and I decided to correct my condition as soon as possible. I informed the Doctor that I would cooperate as I wanted my body to be cleaned of virus. I focused on the type of foods that I take in consultation with the Doctor in the hospital. Most of the items that I took were rich in protein (Eggs, Threptin protein biscuits, Probiotic milk, Dry fruits, fruits and juices etc.). In doing so I found my sugar went up to 460, which I corrected by stopping carbohydrates or packaged juices intake.



**Experiences at the Intensive Care Unit (ICU) and Hospital**

At the time of admission in the ICU, I was accompanied by two other patients who got disturbed by my behavior. One senior patient got annoyed which I also noticed, was shifted to a special ward as his condition improved. The other patient was a defense personal. Later, one more patient came who was critical due to his previous health issues. As stated I accepted my condition and was cooperating with staff, I found that these two patients were not taking food on time. The family members used to visit on time with food etc. but they hardly took any food. The person who joined later was very non-cooperative as he used to remove the oxygen supply mask, for which I used to call the nursing staff many times. Due to his condition, I could not sleep uninterruptedly. It was sad that these two people succumbed to death later on. I hope they had listened to the Doctor and nursing staff properly. They could have survived! Later, I came to know from the Hospital staff that the person with old health issue was having heart problem and did not instruct his wife to inform the hospital about his medication properly which he was taking for last 25 years. When people came to know that I was a scientist, the young and energetic staffs used to come and discuss with me and this kept me energized during my stay at Hospital.

I was moved out of ICU after 10 days, the day my fellow patient died in front of my eyes after putting on ventilator, as he was unable to breathe or even take food. When I moved to the special room, I found members of a family were roaming around and have kept their belongings in the room. I found that their mother was admitted and her oxygen level was not stable. She also expired the same night around 10:00 PM, which really drove me to a very uncomfortable state. Later I came to know that she was suffering from chest infection and sepsis got developed.

It is worth mentioning that my friends had arranged a bed in Sardar Vallabhbhai Patel (SVP) Hospital on April 20, 2021 so that I could get the best possible treatment with utmost care. However, my condition and the prevailing circumstances did not allow my movement for which I was also little worried. I had developed complete faith in Doctor as well as in all the nursing staff who were working tirelessly day and night. We decided that if need arose, I could be shifted, but thankfully that situation never arose.

The Shiv Hospital medical staff was very good. Most of them were young and recent graduates from College of Nursing. The management staff was also good. There were occasions when I shouted on them to improve the hygiene for other patients' conditions. Despite this, they listened to me and did the best they could. After some time, because of all these factors, I started feeling comfortable in the hospital environment and my routine thereof.

**Summary**

I came out of the hospital after spending 10 days in ICU and about 12 days in the special ward. This was possible only through the goodwill of the people with whom I have associated at PRL in the last 25 years, my friends and family who stood by my side in such a critical phase of my life. The lesson I learnt from my experience is that if anyone experiences COVID-like symptoms, they should not wait as I did for 2 days before going for RT-PCR test. In my case, the final confirmation came on 4<sup>th</sup> day after appearing of the 1<sup>st</sup> symptom i.e. mild fever. This delay might have been responsible to take my condition to the very severe category.

At last, I want to say that if anyone has fallen sick with this new disease (COVID-19), which is still under study, they should have faith in the treatment they receive. It is equally important to have food without thinking about its taste, accept its nutrient value with due consultation of the Doctor. At last, the most important point is that he/she should properly inform his/her doctor about the medical history and type of medication.

With best wishes and regards I would like to thank my all friends who stood by me and my family. Without their immensely kind help and support, it was not possible to overcome this phase of my life.



## Obituary



### Dr. Hiralal Razdan

**06.06.1935 to 25.04.2021**

Dr. Hiralal Razdan, former Director, Technical Coordination and Technology Transfer Group, Bhabha Atomic Research Centre, left for his heavenly abode on 25<sup>th</sup> April 2021.

Dr. Razdan was one of the pioneers of Cosmic Ray research in the country. He started his research career at Physical Research Laboratory, Ahmedabad and completed his doctoral thesis on “Study of time variation of Cosmic rays with narrow & wide angle telescopes at Ahmedabad” in 1961 in PRL under the guidance of Dr. Vikram Sarabhai. He did his postdoctoral at the University of New Hampshire, USA, after which he served at NASA, California, USA, for several years. Despite their keenness to retain him on a permanent basis, he chose to return to his country in 1966 to establish facilities for experiments in cosmic rays – his area of interest. He was associated with the setting up of the High Altitude Research Laboratory (HARL) at Gulmarg in North India, where a Neutron Pile was set up in early 1970s. He was instrumental in expanding the scientific activities of the laboratory which led to the establishment of a multidisciplinary research centre, Nuclear Research Laboratory (NRL) at Srinagar. He initiated Gamma-Ray astronomy related activities at HARL in the mid 1980s. These activities led to the setting up of the country’s first imaging gamma-ray telescope, TACTIC, at Mt. Abu and the world’s third largest imaging gamma ray telescope, 21m diameter MACE (Major Atmospheric Cerenkov Telescope), at Hanle in the Ladakh region of North India. Dr. Razdan led the scientific activities of NRL and HARL for more than 20 years before shifting to Mumbai headquarters of BARC, to shoulder important additional responsibilities which included international scientific collaborations and transfer of technologies developed by BARC to industry (e.g.  $\gamma$ -ray sterilization of surgical instruments). He superannuated in 1996 and settled down in Ghaziabad, Uttar Pradesh.

Dr. Razdan was a brilliant scientist and an able administrator who had a knack of nurturing the younger scientists working with him. He was a very self-effacing man with a very friendly disposition who would engage in lively discussions with young and old alike and was loved by everyone he came in contact with. He is survived by his wife, Kanta Razdan, daughter, Seema Bhargava, son, Rajender Razdan, and his grandchildren, Meghaa, Varun, Eishaan and Kundan.

Ramesh Koul  
Ex Head,  
Astrophysical Sciences Division  
Bhabha Atomic Research Centre, Mumbai

## Obituaries



Dr. S.P. Gupta  
Scientist - SG  
(17.09.1941 to 27.04.2021)



Smt. Shantaben Brahmbhatt  
Cleaner - C  
(30.08.1953 to 01.05.2021)

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