भौतिक अनुसंधान प्रयोगशाला, अहमदाबाद

Physical Research Laboratory, Ahmedabad

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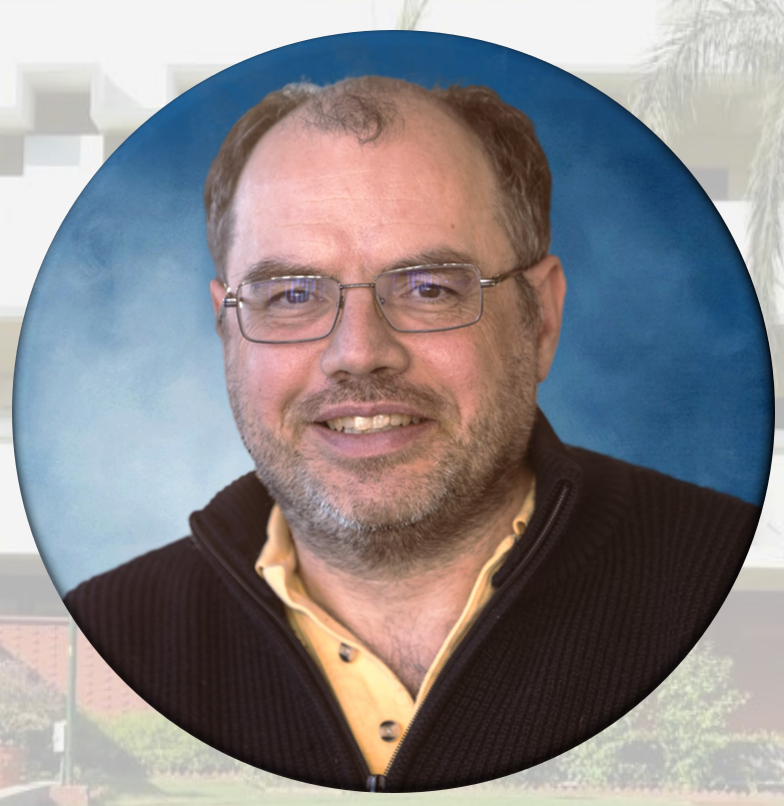
PRL Ka Amrut Vyakhyaan-11

Wednesday, 13 October 2021

@ 16:30 hrs. (IST)

"THE MYSTERY OF VENUS LIGHTNING"



Dr. Ralph Lorenz

Planetary scientist and Engineer at the Johns Hopkins Applied Physics Lab, Maryland, USA.

YouTube https://youtu.be/tFnIPVjN4Ew

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Abstract

Earth's twin planet shines brightly in our skies because of its extensive clouds. But do these clouds, or processes beneath them, produce lightning ? This question has yielded positive and negative answers for over forty years. It seems clear that whistler-mode waves can be observed at Venus, as ample detections by Pioneer Venus (electrical fields) and Venus Express (magnetometer) attest. But there may be non-lightning processes that yield such waves. An important observation is that of Cassini, which detected no lightning radio emissions during two Venus flybys, yet many during an Earth flyby. Such 'control' experiments to understand the false positive rate and detection efficiency of any observation are essential to establishing credible discovery of a phenomenon like lightning.

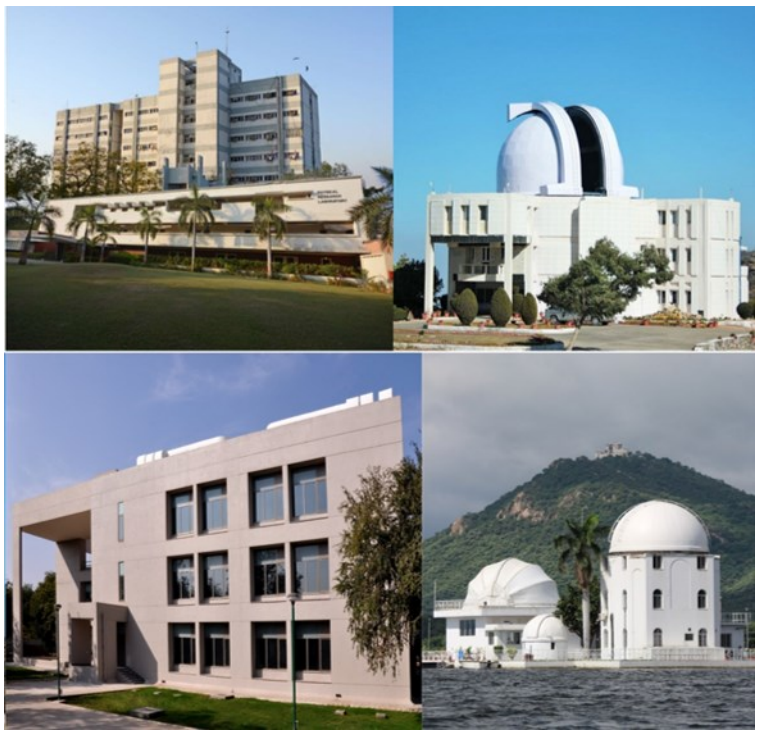
Optical flash surveys have similar negative and positive results. Negative results could be attributed to flashes occurring below the main cloud deck, but the charge generation mechanisms there are not obvious. Positive results may be due to real flashes, or reflections from debris particles shed by spacecraft, or radiation effects. A tentative flash detection by Akatsuki at least appears to rule out a radiation effect by the time signature of the flash. Again, careful control of experiments is essential. Perhaps the only way to finally resolve the question is a combined optical and radio/magnetic observation able to spatially locate a source of both, from an orbiting platform where the time-area product can be large enough to establish statistically-meaningful results.

The Speaker

Dr. Ralph Lorenz worked as an engineer for the European Space Agency on the design of the Huygens probe to Saturn's moon Titan, and as a planetary scientist at the University of Arizona, and since 2006, at the Johns Hopkins Applied Physics Lab. He is associated with NASA's InSight and Perseverance missions at Mars and the Japanese Venus orbiter Akatsuki, and is the Mission Architect for Dragonfly, NASA's next New Frontiers mission. He is also the Atmospheric Structure investigation lead on GSFC's (Goddard Space Flight Center - NASA) DAVINCI+ (Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging, Plus) Discovery proposal. He is author or co-author of nine books including 'Spinning Flight', 'Cassini-Huygens Owners Workshop Manual', 'Exploring Planetary Climate' and 'Space Systems Failures', as well as over 300 journal publications.

About PRL

The Physical Research Laboratory (PRL), known as the “cradle of space science” in India, is one of the premier research institutes founded in 1947 by Prof. Vikram Sarabhai, a renowned Cosmic Ray Scientist, a great visionary and institution builder. PRL played a seminal role in producing a highly motivated cadre of space scientists and the technologists of highest international repute. The first scientific rocket launched from Thumba on 21st November-1963 and many other rockets launched thereafter contained payloads developed at PRL. Dr. Sarabhai initiated many of these scientific and technical activities at PRL which eventually led to the formation of the Indian Space Research Organization (ISRO). Therefore, PRL is known as the “cradle of space science” in India. Further, the research in the area of Plasma Physics expanded to the formation of the Institute of Plasma Research (IPR).



As an institution PRL is unique in that it conducts fundamental research in a wide range of research areas from the Earth to the cosmos, and comprising Astronomy and Astrophysics; Solar Physics; Space and Atmospheric Sciences; Theoretical Physics; Geosciences; Atomic, Molecular and Optical Physics, Astrochemistry; and Planetary Sciences and Space Exploration. PRL is one of the rare research institutes of international repute wherein research in such diverse fields of sciences is carried out using several state-of-the-art experimental facilities that exist under one umbrella.

Along with the ongoing research, several new initiatives have been taken up during the last few years. The Multi-Application Solar Telescope (MAST) at Udaipur Solar Observatory has been operationalized. PRL initiated scientific programmes in frontier areas of research, which include a search for exo-planets, laboratory studies of interstellar grains, laboratory synthesis of cold astromolecules and experimental studies in the field of quantum optics. PRL is also developing several scientific payloads as a part of ISRO’s larger vision and contributing to roadmap for competitive scientific exploration of the solar system and beyond. In particular, PRL has been contributing significantly not only in building instruments for space missions, such as Chandrayaan-1, Chandrayaan-2, AstroSat and upcoming Aditya-L1, Chandrayaan-3 and planetary and space missions, but also by bringing out new and insightful science results.

PRL contributes to several national and international research programmes and to human resource development through its Doctoral and Post-Doctoral Programmes, capacity building programmes, such as UN Course on Space Science, and science and engineering internship programmes. PRL contributes significantly to society through its Outreach Programmes by periodically organizing science exhibitions and Open Houses, planned visits of students of various school and college to PRL, and popular talks at various institutions to not only share the excitements of the advancements of contemporary scientific findings but also to encourage students to take up sciences as their research career.