



# भौतिक अनुसंधान प्रयोगशाला, अहमदाबाद

## Physical Research Laboratory, Ahmedabad

[HTTPS://WWW.PRL.RES.IN](https://www.prl.res.in)

**PRL Ka Amrut Vyakhyaan-23**  
**Wednesday, 05 January 2022**  
**@ 10:00 AM (IST)**

**“Organic Matter in the Universe”**

**Prof. Sun Kwok**

The University of Hong Kong, Hong Kong and  
University of British Columbia, Vancouver, BC Canada



<https://youtu.be/Yvr-eNwbefA>



## PRL ka Amrut Vyakhyaan-23

Title: “Organic Matter in the Universe”

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### Abstract

Recent observational and experimental evidence for the presence of complex organics in space is reviewed. Remote astronomical observations have detected over 200 gas-phase molecules through their rotational and vibrational transitions. Many classes of organic molecules are represented in this list, including some precursors to biological molecules. In the Solar System, almost all biologically relevant molecules can be found in the soluble component of carbonaceous meteorites. Complex organics of amorphous structures are present in the insoluble component of meteorites. Several unidentified astronomical spectral phenomena observed in the interstellar medium are likely to have originated from complex organics. The observation of these spectral features in distant galaxies suggests that organic synthesis had already taken place during the early epochs of the Universe.

In this talk, we will discuss the chemical structures and possible origin of these organics. Specifically, we discuss the possible link between Solar System organics and the complex organics synthesized by stars during the last phases of stellar evolution. Implications of extraterrestrial organics on the origin of life on Earth and the possibility of existence of primordial organics on Earth will also be discussed.

### The Speaker

Prof. Sun Kwok is a professional astronomer and author, specializing in astrochemistry and stellar evolution. He is best-known for his theory on the origin of planetary nebulae and the death of Sun-like stars. His current research is on the topic of the synthesis of complex organic compounds in the late stages of stellar evolution. Before joining the University British Columbia in 2018, he served as Dean of Science and Chair Professor of Space Science at the University of Hong Kong. Previously, he served as Director of the Institute of Astronomy and Astrophysics, Academia Sinica in Taiwan, Killiam Fellow of the Canada Council for the Arts, and Professor of Astronomy at the University of Calgary in Canada.

In addition to publishing in research journals, Prof. Kwok has written a number of books, including *The Origin and Evolution of Planetary Nebulae* (Cambridge, 2000), *Cosmic Butterflies* (Cambridge, 2001), *Physics and Chemistry of the Interstellar Medium* (University Science Books, 2007), *Organic Matter in the Universe* (Wiley, 2012), *Stardust: the Cosmic Seeds of Life* (Springer, 2013), *Our Place in the Universe: understanding fundamental astronomy from ancient discoveries* (Springer 2017) and *Our Place in the Universe – II The Scientific Approach to Discovery* (Springer 2021).

Prof. Kwok has performed extensive service in international organizations, including serving as the President of Astrobiology Commission of the International Astronomical Union (IAU), President of IAU Interstellar Matter Commission, and chairman of IAU Planetary Nebulae Working Group.



## 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 ex-

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 astro-molecules 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.

