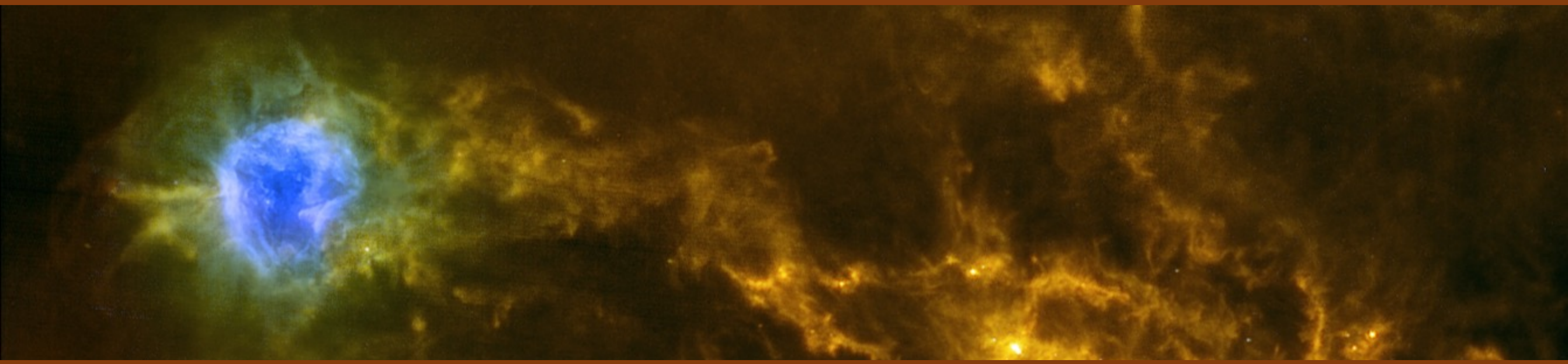
Joint DAA Seminar – ASET Colloquium

Infrared Spectroscopy with Space Cryogenic Telescopes: A Mineralogical Study of Interstellar Dust

Prof. Hidehiro Kaneda (Nagoya University, Japan)



Prof. Hidehiro Kaneda did his Ph.D. from the University of Tokyo in 1997. His main research interests are physics of the interstellar medium (ISM) in our Galaxy and nearby galaxies, cryogenic optics and infrared (IR) instrumentation. He is the PI of Astrophysics Laboratory (U-Lab) in Nagoya University and Co-PI of the Indo-Japanese far-IR balloon observation program T100-FPS, managing the South African IR telescope IRSF. He is a core member of the project teams of GREX-PLUS (space infrared astronomy), SILVIA (formation flight interferometry), DESTINY+ (interplanetary dust), JUStIInE (balloon-borne IR interferometry). He won Best Paper Award in the Publications of the Astronomical Society of Japan (1999) and Editor's Choice, Applied Optics (2005 and 2010).

Space cryogenic infrared telescopes are crucial for studies of solid-state particles (dust) in the universe. The dust plays many critical roles in the formation of stars and planets as well as the growth of galaxies and the evolution of materials therein. The interstellar dust heated by stars emits mostly in the infrared wavelength range from 5 to 200 microns, producing a lot of broad spectral emission and/or absorption features in addition to the blackbody continuum emission with typical temperatures of 20-100 K. In detecting those broad spectral features, very low infrared background with a cryogenically-cooled telescope in space is essential; otherwise thermal radiation from the telescope would overwhelm the signal. Despite their importance from various aspects in astrophysics, the properties of interstellar dust, such as the chemical composition and grain size distribution, are still far from complete understanding due to the difficulty in the observations. In this talk, I first overview the history of space cryogenic infrared astronomy missions starting from IRAS to currently on-going JWST, and introduce key technology for space cryogenic telescopes based on my experience in infrared astronomy satellite projects in Japan, such as AKARI, SPICA and recently GREX-PLUS. Then I explain how the space infrared spectroscopy provides us with a wealth of information on the properties of interstellar dust. In the latter part of my talk, I show the result of our recent mineralogical study on the interstellar silicate dust surrounding super-massive black holes in the centers of galaxies which is called active galactic nuclei (AGNs). The physical and chemical properties of the dust are found to be significantly influenced through the high-energy activity of the AGNs. I discuss the implications of the mineralogical properties of the silicate dust derived from the sample of about 100 dusty AGNs for the evolution of the material in galaxies and also for that of the AGNs themselves. Finally, I talk about our future plans on space infrared astronomy missions.

Tuesday, April 30, 2024 at 4 p.m.
(Hybrid) Lecture Theatre AG 66, TIFR
YouTube Live: https://youtube.com/live/_3EGsgZW7yI?feature=share

This colloquium is on a Tuesday.

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