

第 46 回 RESCEU コロキウム



東京大学大学院理学系研究科 附属ビッグバン宇宙国際研究センター

日 時: 2020年12月10日(木) 17:00~18:00

場 所: オンライン (Zoom)

講 師: Akira Endo 氏 (Delft University of Technology, on behalf of the DESHIMA collaboration)

DESHIMA: Integrated Superconducting Spectrometer for Wideband Submillimeter Astronomy

Abstract

The integrated superconducting spectrometer (ISS) enables ultra-wideband, large field-of-view integral-field-spectrometer designs for mm-submm wave astronomy. DESHIMA (Deep Spectroscopic High-redshift Mapper) is a single-pixel ISS spectrometer for the ASTE 10-m telescope, designed to observe the 220-440 GHz band in a single shot, corresponding to a [CII]-line redshift range of $z=3.3-7.6$.

In this colloquium I will present the instrument concept, design, and first on-sky results of DESHIMA, obtained from October to December 2017 on the ASTE telescope. On the ISS chip of DESHIMA, the signal is captured by a lens-antenna and subsequently travels through a coplanar waveguide made of superconducting NbTiN, from which NbTiN bandpass filters branch out to divide the signal into separate frequency channels. At the output of each filter is a NbTiN/Al hybrid microwave kinetic inductance detector (MKID). The first generation of DESHIMA (DESHIMA 1.0) is a 1-pixel spectrometer that covers the 332-377 GHz band with 49 spectral channels, offering a spectral resolution $F/dF \sim 380$. We present detection of molecular emission lines from various sources, including a weakly redshifted CO line from the luminous infrared galaxy VV 114. The on-sky performance shows excellent agreement between the design and laboratory measurement in terms of the sensitivity, optical efficiency and beam pattern. In addition, we present wideband spectral maps of extended sources to demonstrate the potential of the ISS technology towards spectroscopic direct imaging.

Ongoing upgrades towards the octave-bandwidth full system (DESHIMA 2.0) include the development of a filterbank chip with ~ 350 channels and higher optical efficiency, a wideband quasioptical design, and observing methods for efficiently removing the atmosphere. DESHIMA is a collaboration between the Netherlands (TU Delft, SRON, Leiden University, +) and Japan (University of Tokyo, Nagoya University, Kitami Institute of Technology, NAOJ, +).

興味をお持ちの方の聴講を歓迎致します。