V119a DESHIMA 2.0: Development overview of the 220–440 GHz integrated superconducting spectrometer and the planned scientific observation campaign on ASTE

A. Taniguchi, T. J. L. C. Bakx, K. Matsuda, Y. Tamura (Nagoya), T. Takekoshi (Kitami), P. P. van der Werf (Leiden), R. Kawabe, T. Oshima (NAOJ), T. Kitayama (Toho), J. J. A. Baselmans, S. Brackenhoff, B. T. Buijtendorp, S. Dabironezare, A. Endo, M. Gouwerok, S. Hähnle, K. Karatsu, N. Llombart, A. Pascual Laguna, M. Rybak, D. J. Thoen (TU Delft), H. Akamatsu, R. Huiting, V. Murugesan, S. J. C. Yates (SRON), T. Ishida, K. Kohno (UTokyo), and DESHIMA team

Integrated superconducting spectrometer (ISS) technology will enable ultra-wideband submillimeter spectroscopy for uncovering the dust-obscured cosmic star formation and galaxy evolution over cosmic time. Here we present the current status of DESHIMA 2.0 (Taniguchi et al. arXiv:2110.14656), an ISS that will observe the 220–440 GHz band ($z = 3.3$–7.6 for [C II] 158 μm) with a resolution of $F/\Delta F \simeq 500$ in a single shot.

As a successor to DESHIMA 1.0 (332–377 GHz band), we upgraded the wideband chip design and the quasi-optical system. We fabricated the first chip in mid 2021 and the filter response measurement shows that it merits telescope observations. For better observation efficiency, we also developed a fast sky-position chopper and a data-scientific sky-noise removal method. With all the upgrades, we expect to detect (S/N > 5) the [C II] line of a bright dusty star-forming galaxy (DSFG; $L_{\rm IR} = 3 \times 10^{13} L_\odot$) in an eight-hour ASTE observation.

A three-month scientific observation campaign is planned on ASTE in 2022, including a spectroscopic survey toward high-z DSFGs and a mapping of a galaxy cluster to detect the thermal Sunyaev-Zel'dovich effect signal.