V120b DESHIMA: A New Baseline Subtraction Method for Ultra-wideband Spectra

A. Taniguchi, Y. Tamura, K. Suzuki (Nagoya University), T. Takekoshi (University of Tokyo), A. Endo, S. Ikarashi (TU Delft), T. Tsukagoshi (NAOJ), and the DESHIMA collaboration

We are developing an ultra-wideband imaging spectrometer in the sub/mm, DESHIMA (DEep Spectroscopic HIgh-redshift MApper), employing an on-chip filter bank and microwave kinetic inductance detectors (MKIDs). In ASTE/DESHIMA commissioning in 2017, we have already achieved an intstantaneous bandwidth of 45 GHz (Endo; ASJ meeting 2018 spring). In the reduction of such ultra-wideband time-series data, however, we find that the time variation of opacity, $\tau(t)$, is no longer constant over the waveband but has a frequency dependency like $\tau(\nu, t)$, from both observation and model. This makes spectral baseline strongly non-linear, which should fail the conventional baseline subtraction by a constant or polynomial function.

In this poster, we introduce a new spectral baseline subtraction method for such data. Using the ALMA atmospheric model, we express the frequency-dependent $\tau(\nu, t)$ by frequency-independent precipitable water vapor, PWV(t), and fit baseline of each spectrum by estimating PWV(t) and constant value, $C(t)$, instead of coefficients of a polynomial function. We demonstrate that this method clearly subtracts scanning effect compared to conventional method in a map cube of a Orion OTF observation. We also find that this method keeps continuum emission as $C(t)$, which may offer a new way of "spectral cleaning" for continuum observations.