

Results of SMILES and the plan of follow-on THz mission, SMILES-2

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Abstract—The Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) measured the Earth's atmosphere by receiving submillimeter limb-emission spectra with SIS receivers at 625 and 650 GHz on the International Space Station from October 2009 to April 2010. The SMILES observations provided new knowledge of the middle atmosphere. For example, the diurnal variation of the stratospheric ozone was observationally shown for the first time. The evidence of the diurnal variation has impacted on long-term ozone trend analysis that uses several ozone data obtained at different local time depending on the measurement methods. SMILES also demonstrated wind measurement by submillimeter limb sounding. It had been challenging to detect the small Doppler shift due to wind, which is less than a hundredth of the line width of molecular emission in the stratosphere. The successful wind measurement inspired new projects on wind measurement by submillimeter limb sounding.

SMILES-2 is a proposed mission for comprehensive observation of the Earth's atmosphere with SIS and HEB receivers. The main objectives of SMILES-2 are to understand diurnal variations and true steady background of the atmosphere above the tropopause. Frequency bands including 2 THz channel are chosen for SMILES-2 so that wind and temperature in all the altitude range from the stratosphere to lower thermosphere can be measured with high precision, and also various minor species in the atmosphere can be observed.

In this talk, I present some of the scientific results of SMILES, as well as a plan of future comprehensive atmospheric observation by submillimeter limb sounding from space.