

Terahertz Limb Sounder for Lower Thermosphere Wind, Temperature, and Atomic Oxygen Density Measurements

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In this paper, we present the concept of a high-sensitivity heterodyne spectrometer operating at 2.0 Terahertz (THz) for global lower thermospheric neutral wind, temperature and atomic oxygen density measurements from a low earth orbit. The instrument, THz Limb Sounder (TLS) is aimed to provide, for the first time, global neutral wind/temperature/density profile measurements globally during day and night, with focus at altitudes of 100-150 km where most of the ion-neutral energy/momentum couplings take place. TLS is an ambient-temperature Schottky diode based all solid-state heterodyne spectrometer designed to extend the limb sounding technique employed by Microwave Limb Sounder for density/temperature/wind measurements by measuring the Doppler line shape of atomic oxygen (OI) fine structure emission at 2.06THz. This atomic oxygen line emission is very bright and distributed nearly uniformly globally (at all latitudes including highly spatially structured aurora particle precipitation regions) and temporally (at all local times during both day, night, and twilight), thus ideal for thermospheric remote sensing. The instrument concept, measurement methodology, receiver performance, and the expected measurement capability will be presented and discussed in this paper.

Keywords: Lower Thermosphere Wind, Temperature, and Density, Remote Sensing Technique and Instrument, TeraHz Spectrometer