A report describes the Submillimeter Planetary Atmospheric Chemistry Exploration Sounder (SPACES), a high-sensitivity laboratory breadboard for a spectrometer targeted at orbital planetary atmospheric analysis. The frequency range is 520 to 590 GHz, with a target noise temperature sensitivity of 2,500 K for detecting water, sulfur compounds, carbon compounds, and other atmospheric constituents. SPACES is a prototype for a powerful tool for the exploration of the chemistry and dynamics of any planetary atmosphere. It is fundamentally a single-pixel receiver for spectral signals emitted by the relevant constituents, intended to be fed by a fixed or movable telescope/antenna. Its front-end sensor translates the received signal down to the 100-MHz range where it can be digitized and the data transferred to a spectrum analyzer for processing, spectrum generation, and accumulation.

The individual microwave and submillimeter wave components (mixers, LO high-powered amplifiers, and multipliers) of SPACES were developed in cooperation with other programs, although with this type of instrument in mind.

Compared to previous planetary and Earth science instruments, its broad bandwidth (≈13%) and rapid tunability (≈10 ms) are new developments only made possible recently by the advancement in submillimeter circuit design and processing at JPL.

This work was done by Erich T. Schlecht, Mark A. Allen, John J. Gill, Choonsup Lee, Robert H. Lin, Seth Sin, Imran Mehdi, and Peter H. Siegel of Caltech; and Alain Maestrini of the Observatoire de Paris for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-48207