OPTICAL MODULATION SPECTROMETER: A CONCEPT STUDY

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This poster presents the preliminary results of a concept study for an ultra-wideband (>10 GHz) optical modulation spectrometer (OMS). Broadband spectrometers will be required when heterodyne receiver systems operating from 1 to 3 THz go online. Large bandwidths are required to observe broad emission or absorption lines from extra-galactic objects at high redshifts, to perform spectral line surveys, and to observe planetary atmospheres. Many of these lines are pressure or velocity broadened with either large half-widths or line wings extending over several GHz. Current backend systems can cover the needed bandwidth only by combining the output of several spectrometers, each with typically up to 1 GHz bandwidth, or by combining several frequency shifted spectra taken with a single spectrometer. The ultra-wideband optical modulation spectrometer with at least 10 GHz bandwidth will enable broadband observations without the limitations and disadvantages of hybrid spectrometers.

In an optical modulation spectrometer, laser light from a laser diode is first phase modulated in a broadband electro-optical modulator by the intermediate frequency (IF) signal from a heterodyne receiver. The modulated light is then fed into a Fabry-Perot etalon system with high finesse. Finally, the transmitted interference pattern is focused onto a linear detector array where each detector measures the spectral intensity for a different IF frequency.

Since the principle of the OMS is very similar to acousto-optical spectrometers, it can be assumed that the spectrometer can be built with small volume (< 1 cubic ft), low mass (< 10 kg), and small power consumption (< 10 Watts). These specifications make it a candidate for a broadband spectrometer for space-borne applications.