Researchers get clearer view of Earth's atmosphere --- from the laboratory

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For scientists who want to discern the complex chemistry at work in Earth's atmosphere, detecting a particular gas molecule can be as hard as finding a proverbial needle in a haystack.
Frank De Lucia, professor of physics at Ohio State University , and his colleagues recently used their FAST Scan Submillimeter Spectroscopy Technique (FASSST) to make the job easier.

The technique offers a way for scientists to examine the spectrum of light given off by a molecule. Each molecule has its own one-of-a-kind spectral pattern, like lines in a bar code. FASSST takes a snapshot of a wide range of spectral wavelengths, so scientists can easily recognize the pattern of the molecule they are looking for. Experiments that have traditionally taken weeks or months can be completed in a few seconds.

At the 60th International Symposium on Molecular Spectroscopy, hosted by Ohio State University , De Lucia and doctoral student Andrey Meshkov reported that the FASSST technique can be used to help scientists remove the signals from molecules that interfere with studies of gas systems such as Earth's atmosphere.

De Lucia used the example of a problem common to his collaborators at NASA: satellite measurements of chemicals involved in the creation or destruction of ozone.

“Say you're trying to look though the atmosphere to see small amounts of hydrogen peroxide. You have to understand how the signal from the

hydrogen peroxide changes as it travels through the atmosphere to a satellite," he said. "The path that the signal follows can be thousands of kilometers long, so you have to be able to subtract out the part of the atmosphere that you don't care about to get at the really small effects that you do care about."

The background signal from other molecules that scientists are not interested in -- frequently molecules of water, oxygen, or nitrogen -- is called the continuum. FASSST lets scientists get a handle on the continuum signal by essentially freezing an atmosphere in time so scientists can remove the parts they don't want.

In their latest results reported at the symposium, De Lucia and Meshkov used FASSST to simultaneously measure the contributions of water, oxygen, and nitrogen to the continuum in an experimental gas mixture they created in the laboratory.

De Lucia said his colleagues at NASA and elsewhere can use experimental data from FASSST to better interpret satellite data and reduce error in their measurements.

The same technique aids detection of chemicals in the lab in general. Several of the presentations at the symposium are based on FASSST analyses of chemicals important to research in astronomy and biology.

Link: Physics at Ohio State University

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