Exoplanets soon to gleam in the eye of NESSI

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The New Mexico Institute of Mining and Technology's 2.4-meter (7.9-foot) Magdalena Ridge Observatory in Socorro County, N.M. Credit: New Mexico Tech

(Phys.org) —The New Mexico Exoplanet Spectroscopic Survey Instrument (NESSI) will soon get its first "taste" of exoplanets, helping

astronomers decipher their chemical composition. Exoplanets are planets that orbit stars beyond our sun.

NESSI got its first peek at the sky on April 3, 2014. It looked at Pollux, a star in the Gemini constellation, and Arcturus, in the Boötes constellation, confirming that all modes of the instrument are working.

"After five years of development, it's really exciting to turn on our instrument and see its first light," said Michele Creech-Eakman, the principal investigator of the project at the New Mexico Institute of Mining and Technology in Socorro, N.M. "Planet hunters have found thousands of exoplanets, but what do we know about them? NESSI will help us find out more about their atmospheres and compositions."

Partly funded by NASA's EPSCoR (Experimental Program to Stimulate Competitive Research), in partnership with the New Mexico Institute of Mining and Technology, the NESSI instrument is located on the institute's 2.4-meter Magdalena Ridge Observatory in Socorro County, N.M.

NESSI will focus on about 100 exoplanets, ranging from massive versions of Earth, called super-Earths, to scorching gas giants known as "hot Jupiters." All of the instrument's targets orbit closely to their stars. Future space telescopes will use similar technology to probe planets more akin to Earth, searching for signs of habitable environments and even life itself.

NESSI is one the first ground-based instruments specifically crafted to study the atmospheres of exoplanets that transit, or eclipse, their stars, from our point of view on Earth. It uses a technique called transit spectroscopy, in which a planet is observed as it crosses in front of, then behind, its parent star. The instrument, called a spectrometer, breaks apart the light of the star and planet, ultimately exposing chemicals that

make up the planet's atmosphere. The technique is challenging because a planet's atmospheric signal accounts for only one part in 1,000 of the star's light. It's like looking for a firefly in a searchlight.

NASA's Spitzer and Hubble Space Telescopes, though not designed for studying exoplanets, have used the same method from space, gathering data on far-off worlds. Because space is above the blurring and attenuation effects of Earth's atmosphere, it is a better place than our planet to collect an exoplanet's chemical or spectral information. But ground-based studies have advantages, too. They can be developed at lower costs and allow researchers to update instruments more easily.

To work around Earth's atmospheric blurring problem, the NESSI instrument has a relatively wide field of view, covering a patch of sky about half the size of the full moon. This allows it to place two or more stars in its sight at once—both the star it is analyzing as the target planet circles around, and other control stars. When the atmosphere moves around during an observation, it affects both stars similarly. This allows the researchers to isolate and remove the blurring distortions.

NESSI will be able to see a wide range of wavelengths in the near-infrared region of the light spectrum. "We can probe multiple signatures of molecules all at the same time, a special feature of NESSI," said Mark Swain, an astronomer on the NESSI project from NASA's Jet Propulsion Laboratory, Pasadena, Calif.

The instrument includes a cryogenic dewar that will keep it super-cooled with liquid nitrogen. That's an important factor for infrared-seeing telescopes, which are sensitive to heat.

Ten undergraduate students helped to make NESSI happen. "We're watching the next generation of scientists and engineers get excited about exoplanets," said Creech-Eakman. "Who knows what they will be

able to see when they're older—perhaps the atmospheres of potentially habitable worlds."

Provided by NASA