StellarNet Customer Spotlight

Dr. Ed Wilson, Harding University

Launching Spectrometers and Careers

Harding RockSat-C Team with payload: In Harding University's Atmospheric and Space Research Team, Stellarnet's spectrometers examine the cosmos and educate at the same time. Shown here is a Black comet mounted on payload chassis for deployment on a NASA sounding rocket. Team members left to right – Joshua Griffith, Will Waldron, Andrew Cancienne, and Dr. Ed Wilson, back center.

An interview with Dr. Ed Wilson, Professor of Chemistry, Harding University

Technical Application

The Harding University Atmospheric and Space Research Team operates under the leadership of Dr. Ed Wilson, Professor of Chemistry in Harding University's Department of Chemistry and Biochemistry, and longtime StellarNet customer. The team's research has been funded by several sources over the years, including NASA Astrobiology Science and Technology Instrument Development (ASTID), NASA Experimental Program to Stimulate Cooperative Research (EPSCoR), and the Arkansas Space Grant Consortium.

Through this research, Harding undergraduate students gain valuable hands-on experience and knowledge in chemistry and physics. Current research projects include analysis of hybrid rocket motor exhaust plumes, development of a distributed spectrometer for use on a future NASA rover mission to Mars, and studies of atmospheric chemical reaction kinetics. The Harding team has also competed in NASA's annual University Student Launch Initiative, in which they designed, built, and flew a hybrid rockets with a scientific payloads.

.

Harding RockSat-C Team standing in front of Launch Vehicle at NASA's Wallops Flight Facility at Wallops Island launch site in Virginia.

Dr. Wilson likes both building instrumentation for space research applications and educating the next generation of STEM people coming into the workforce. Through these research projects, Dr. Wilson's students have received scholarships and fellowships from the National Space Grant Program enabling them to enter the workforce with confidence in extremely exciting fields.

Technical Application

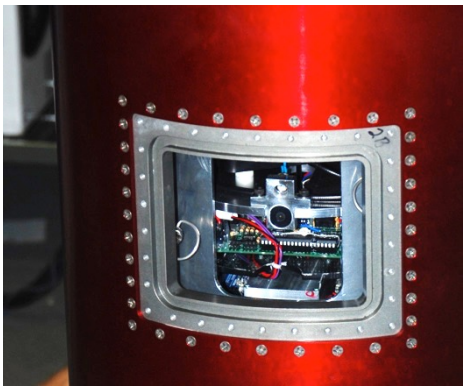
SATURN'S MOON, TITAN, WITH A SILVER NOVA

The Harding team collaborates with professors and students at the University of Arkansas Fayetteville's Center for Space and Planetary Sciences. At the present time a StellarNet Silver NOVA is being adapted for Raman spectroscopy experiments in the Center's Titan Chamber.

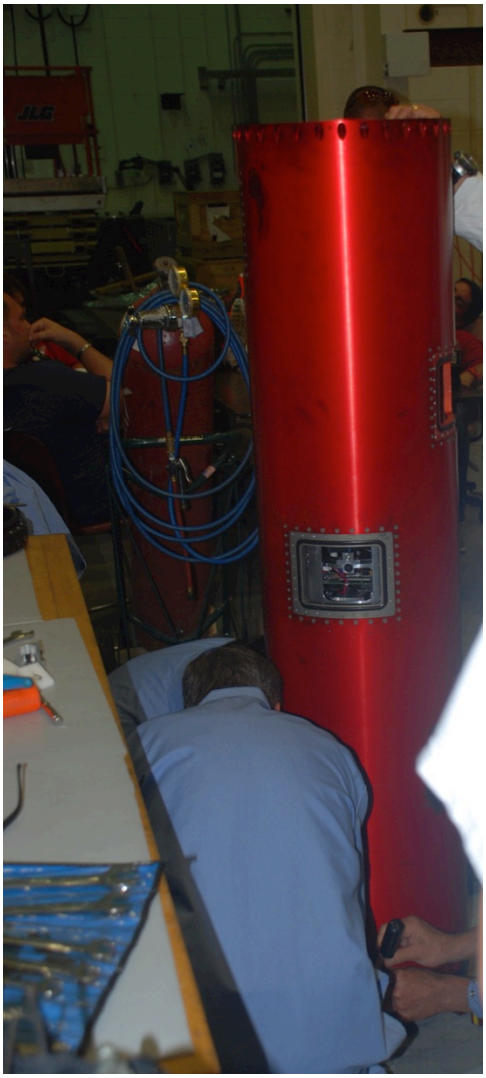
BLACK COMETS SAIL TO THE EDGE OF SPACE

"We've mounted StellarNet Black Comet spectrometers on rockets launched from Wallops Island off the coast of Virginia," says Dr. Wilson. The spectrometers travelled 72 miles through the atmosphere to the edge of space and were recovered safely after splashdown in the Atlantic Ocean."

"The advantage of the StellarNet products is that they are robust and have no moving parts," says Dr. Wilson. This is extremely important for performance because, before any instrument is sent up in a rocket from Wallops, all payloads are subjected to an exhaustive system of tests: the payloads are shaken at all different frequencies and extremely high velocities to see if anything breaks loose.



The payload mounted in the launch rocket before launch above and after ocean recovery, below.



VENUS WITH A RED WAVE

The team is determining the feasibility of using a StellarNet Red Wave NIR Spectrometer to study geological samples under the warm conditions similar to what might be found on Venus. StellarNet spectrometers are fiber-fed and this makes them very easy to use in difficult spaces like the Venus Chamber at the Center for Space and Planetary Sciences.

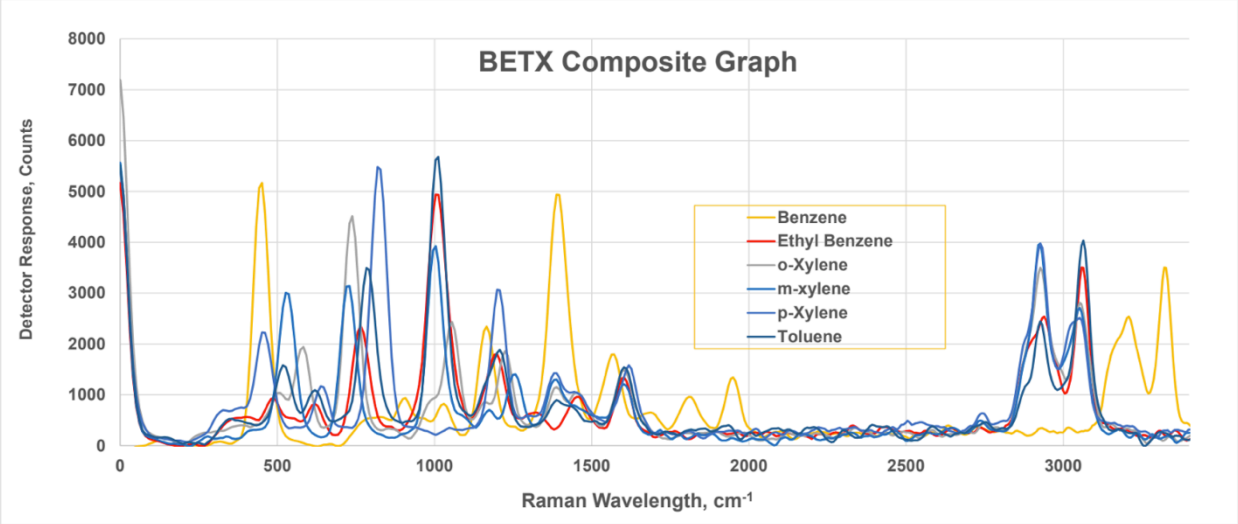
A RAMAN SPECTROMETER FOR SPACE MISSIONS

One of the projects the team is working on is developing Raman instrumentation for space missions. The team used a StellarNet Black Comet spectrometer to custom-build a Raman spectrometer. Raman spectroscopy has been known and used for 90 years; however, it wasn't until the advent of diode lasers that Raman usage began to expand. Although not as powerful as a gas or solid state lasers, diode lasers can

now emit large amounts of photons over a narrow wavelength range making them highly useful for constructing compact Raman spectrometers. Advantages of Raman Spectroscopy over its chief competitor, Infrared Spectroscopy, are ~~that~~: water can be used as the solvent, sample holder windows can be of glass or quartz instead of sodium chloride, potassium bromide or cesium iodide and the intensity of the recorded spectra are not dependent on the path length of radiation but only on the concentration of the substance measured.

The team designed, built and calibrated a compact Raman Spectrometer in their laboratory for evaluation for space mission use. In addition to the advantages listed, the Raman Spectrometer had no moving parts; a distinct plus when comparing Raman instruments with complicated Fourier Transform Infrared Spectrometers (FTIR) having delicate and precise moving parts.

A novel feature of that design, based on ideas published in the doctoral dissertation of Richard Homard and mentored by Keith Hudson, is the use of mirrors to enhance the signal. This instrument, based on a Thorlabs HL6545MG single mode laser, emitting 130 mW of energy at 660.5 nm and employing a StellarNet Black Comet, Super Range, Fiber Fed Spectrometer of wavelength range 200 nm to 1080 nm as the detector produced Raman spectra in the range of 237 cm-1 to 5279 cm-1 that closely match spectral databases published in the scientific literature.



Composite spectra of BETX sample obtained from the Harding Raman Spectrometer. BETX is the acronym for benzene, ethyl benzene, toluene and o-, m- and p-xylene, a common set of substances found in many areas including fuels, wastewater, industrial sites, etc.

WHY STELLARNET?

Dr. Wilson doesn't remember how he found StellarNet, but continues to purchase from StellarNet because of the strong relationship developed over the years. "StellarNet's prices

are very good, the products are good, and they're pleasant to deal with. I feel like I have some relationships with them," he says. "That's one things I've learned in life about why people buy – relationships. Most people want to feel valued."

There are additional reasons why Dr. Wilson buys from StellarNet. "The advantage of the StellarNet products is that there are no moving parts." The minimization of moving parts is essential in space applications where the vibrations and velocities of launch vehicles are very demanding.

THE FUTURE IS BRIGHT

Dr. Wilson is semi-retired, but is too excited about the future to stop looking to the skies. "People are building the small, handheld Raman spectrometers, so research is going through a big surge towards Raman technology as compared to infrared. The little diode lasers really help to make the Raman spectrometers compact." Additionally, his students have found ways to get the data from the instruments to their cell phones. Wilson continues to write grants and pursue opportunities where he and his students can continue to look to the sky.

Dr. Wilson can be found online at www.Harding.edu/wilson.