EXPLORING NEW SPECTRAL WINDOWS WITH THE HERSCHEL SPACE OBSERVATORY

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The Herschel Space Observatory, an ESA cornerstone mission with NASA participation, has been in operation for over a year. I will briefly outline the overall capabilities of Herschel which has both photometric and spectroscopic coverage from 63 to 610 microns. Herschel offers unprecedented sensitivity as well as continuous spectral coverage across the gaps imposed by the atmosphere, opening up a largely unexplored wavelength regime to high resolution spectroscopy. In particular, I will present results from the guaranteed time key program: *Herschel observations of EXtra-Ordinary Sources (HEXOS)*. Our program is nearing completion of data acquisition and I will discuss the most complete molecular spectrum of star-forming gas ever obtained in the spectrum of Orion KL and the galactic center molecular cloud Sagittarius B2. These spectra have over 1.4 THz of bandwidth and a resolution of 1 MHz. We estimate that there are over 100,000 spectral lines alone in the Orion KL spectrum with numerous lines of water vapor, ammonia, sulfur-bearing molecules, and numerous organics. I will demonstrate the power of molecular spectroscopy in characterizing the physical state of dense gas near massive stars through the perspective offered by observations of hundreds of lines of a single molecule and are revealing a new tracer of active galactic nuclei. I will show how the spectra provide a near complete chemical assay and cooling census of star-forming gas. Ultimately the gains from Herschel have tremendous potential to extend our understanding of the physics of star birth and feedback while informing on the origin of water and organics in space.