

A SPATIAL HETERODYNE SPECTROMETER FOR VERY HIGH RESOLUTION SPECTROSCOPY AT SRC

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All reflection Spatial Heterodyne Spectrometer (SHS) designs have the potential to revolutionize spectroscopy in the VUV. The advantages of (interferometric) Fourier transform spectrometers (FTS's), including the ubiquitous FTIR spectrometers and major national research instruments such as the Kitt Peak 1 m FTS, are well known. These advantages include: (1) very high spectral resolving powers, (2) the etendue advantage of ~ 100 over grating spectrometers, (3) excellent absolute wavenumber accuracy, (4) extremely broad spectral coverage, (5) high data collection rates, and (6) insensitivity to source drift during intensity measurements over wide spectral ranges. In addition to the lack of transmitting optics, the SHS has other advantages. Optical imperfections are much more serious in a traditional Michelson FTS than in a SHS. The localized fringes of equal thickness in a SHS deviate from straight lines due to optical imperfections, but such deviations can be corrected with software after transferring the interferogram from the CCD. Similar optical imperfections from either figure or index of refraction variations in a Michelson FTS lower fringe contrast and degrade the instrument sensitivity. The use of a CCD detector array to record the spatially distributed interferogram means that the SHS is quite compatible with transient, low duty cycle sources which are common in the VUV. We are constructing a SHS which has promise of extending spectroscopic interferometry to the window limit ($\sim 90,000$ cm⁻¹ or 11 eV) and eventually above the window limit. Our SHS will replace the 3 m vacuum echelle on the SRC White Beam line. Synchrotron radiation is crucial for gas phase absorption experiments in the deep UV and for radiometric calibration. This talk will include a review of the basic principals of SHS instruments, a description of our new broadband VUV SHS, and a discussion of advanced grazing incidence SHS designs for even short wavelengths.

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