CESAR: Compact Echelle Spectrograph for Aeronomic Research

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With funding from the National Science Foundation Major Research Instrumentation program, plans are underway for designing, constructing, and fielding a relocatable Compact Echelle Spectrograph for Aeronomic Research (CESAR) – a scaled version of the HIRES instrument on the 10-m Keck I telescope on Mauna Kea, Hawaii. CESAR features f/1 camera optics, CCD detection with a range of 310-1040 nm, a resolution of 20,000, and instantaneous spectra over 500 nm. The anticipated sensitivity is 3 photoelectrons R^{-1} s^{-1}.

Sky spectra from HIRES and other large telescopes have revealed many new and interesting features in the terrestrial nightglow [Cosby et al., 2006; Cosby and Slanger, 2007; Sharpee et al., 2005; Slanger et al., 2003; Slanger et al., 2006; Slanger et al., 2004; Slanger and Osterbrock, 1998], however data has been collected as background spectra for astronomical observations. While such background spectra have proven useful, emphasis on astronomical targets has yielded suboptimal spatial and temporal sampling for the aeronomer. CESAR will give the aeronomy community full access to such an instrument and we anticipate this new data set will have a major impact on the study of the upper atmosphere.

CESAR will initially be deployed near Fairbanks Alaska at the Poker Flat Research Range, complementing the newly-constructed incoherent scatter radar, AMISR. This site will serve as the commissioning phase of the program and will benefit from ancillary optical and RF diagnostics present at the range. Since CESAR is relocatable, this instrument could be moved to an ionospheric heating facility, such as HAARP, in the future. Emphasis in optical studies supporting heating studies has typically been to observe the oxygen red line (630 nm), the green line (557.7 nm), and rarely the 427.8 nm N_2^+ 1N emission via narrowband filters. The typical intensities reported are large compared to the capabilities of CESAR. Optical observations during ionospheric modification experiments would benefit greatly from CESAR's spectrally wider field of view of the emissions generated.