

CESAR, The Compact Echelle Spectrograph

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In recent years it has been shown that an untapped resource for aeronomers are the sky spectra that are routinely produced at the giant optical telescopes, such as Keck I/II (Hawai'i) and the VLT (Chile). The extraordinary quality of these spectra prompted the aeronomy community and the National Science Foundation to support the construction of a large echelle spectrograph (CESAR) with many of the same properties as the echelle instruments on the big telescopes (HIRES, ESI, UVES), but with the ability to relocate as needed, particularly to higher latitudes. Furthermore, the astronomical sky spectra that we have accessed are a by-product of the astronomers' protocols, so we had no input into the details of how they were obtained. It was therefore of high priority to build our own spectrograph.

CESAR is dedicated to nightglow/auroral studies at variable high spectral resolution ($R_{\max} \sim 15000$) between 3200 and 10500 Å. Since November 2013 it has been at the Poker Flat Research Range, and has been taking spectra nightly of aurora and nightglow, running at a resolution of $R \sim 5000$ (0.14 nm at 700 nm). This is quite sufficient to give rotational resolution for the principal molecular emitters, the O₂ Atmospheric bands, the N₂ First Positive bands, and the N₂⁺ Meinel bands. The development of CESAR was conducted by SRI International, and the optical design and integration of the spectrograph camera is based on the camera of the HIRES spectrograph at the Keck I telescope on Mauna Kea, using an initial optical design from A.L. Broadfoot.

First results emphasized the study of the O₂ Atmospheric bands in aurora, following up on the work of Sivjee and colleagues. Most of the O₂ bands are overlapped with N₂/N₂⁺ features (although this is not a serious issue at CESAR's resolution), but of particular interest is the realization that the weak O₂(b-X) 2-1 band, never before examined, is almost devoid of interference. In this presentation we will describe CESAR and show some of the early data.