FAR-ULTRAVIOLET OBJECTIVE SPECTROGRAPHIC SURVEYS FOR MAPPING OF INTERSTELLAR H_2, H, AND CO

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A far-ultraviolet, wide-field camera/spectrograph investigation has been proposed for Spacelab missions. By use of an objective grating, this experiment could survey large areas of the sky, obtaining spectra of early-type stars as faint as 12th visual magnitude in the 950-2000 Å wavelength range, with 1 to 2 Å spectral resolution.

A major objective of this proposed objective-spectrographic survey would be mapping of the distributions of interstellar atomic and molecular hydrogen over large areas and in many different regions of the sky. An objective-grating survey can achieve this with much greater observational efficiency than possible with a conventional telescope/spectrometer (which can observe only a single star at a time).

To determine the optimum spectral resolution of such a survey, we have computer-degraded typical Copernicus U2 spectra (0.2 Å resolution) to equivalent resolutions of 1 to 32 Å. We find that degradation to 1 or 2 Å resolution still permits acceptably accurate determination of H and H_2 column densities in the directions of moderately reddened stars, while greatly improving the limiting sensitivity for a given instrumental aperture.

Such a survey would also be useful for mapping interstellar CO in the directions of highly reddened stars if a higher-dispersion objective grating were used. The survey could also map the distribution of interstellar dust with greater sensitivity than possible from the ground if sensitivity were provided in the middle ultraviolet (including the interstellar extinction "bump" near 2200 Å). The distribution of dust could then be directly correlated with the atomic and molecular column densities.

The astrophysical significance of such a survey is that it would provide a statistical basis for comparing with theoretical predictions the observed relationships between H_2/H ratio, local gas and dust density, local ultraviolet radiation intensity, etc., that would be much

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better than the one derived from the present, limited Copernicus surveys, which include somewhat more than 100 stars. The proposed survey could reach several thousand stars, including many highly reddened and/or distant galactic stars, plus the brighter early-type stars in the Magellanic Clouds.

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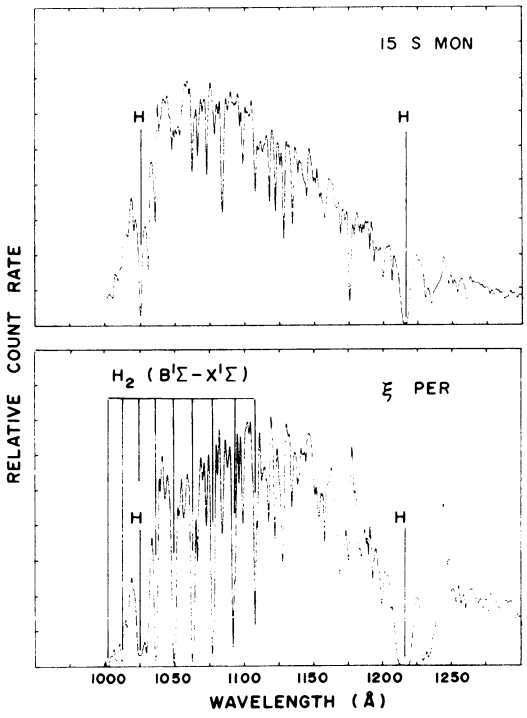

Comparison of Copernicus U2 spectra, computer-degraded to 2 Å spectral resolution (equivalent to that of the proposed objective-grating survey), of two stars: (Top) 15 Mon, a nearly unreddened 07 star (E(B-V)=.07) and a reddened 07 star, ξ Persei (E(B-V)=0.32). Note the strong interstellar H_2 absorptions in the latter spectrum.

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