THE WHAM SPECTROMETER: DESIGN, PERFORMANCE CHARACTERISTICS, & FIRST RESULTS

by

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Abstract

The Wisconsin H-Alpha Mapper (WHAM) is a unique new facility designed to study faint optical emission lines from diffuse ionized gas in the disk and halo of the Galaxy. WHAM consists of a 15 cm aperture, dual-etalon Fabry-Perot spectrometer coupled to a 0.6 m siderostat. Its primary purpose is to conduct a sensitive kinematic survey of the northern sky ($\delta >$ -30°) in the Hα line from Kitt Peak with 1° spatial resolution and 12 km s^{-1} spectral resolution. This survey will provide the first detailed information about the warm ionized medium (WIM), a recently recognized major component of the interstellar medium.

After reviewing the basic properties of Fabry-Perot systems, I describe our specific technique for utilizing them, which involves the use of dual-etalons in series, pressure tuning, and imaging of the ring pattern passed by the etalons onto a CCD detector. A description of the WHAM optical system is also included. Measurements of the performance characteristics of the WHAM spectrometer relevant to producing a

calibrated spectrum are presented. I include detailed studies of the instrument profile function, linearity, wavelength and intensity calibration, the imaging performance of the optical system, sensitivity, the CCD detector properties, and noise. The spectrometer is found to meet or exceed its design specifications in all important aspects.

The first observations using the WHAM spectrometer include a study of emission lines from high velocity clouds in the M complex. The results include clear detections of Hα emission from a number of locations toward the M I and M II clouds with intensities of 0.1 – 0.2 R. Another study obtained the first detections of the He I λ5876 recombination line from the WIM. This line has been detected in four directions in the Galactic plane, and the intensity ratios of the λ5876 line to Hα indicate that the spectrum of the radiation ionizing the WIM is significantly softer than that emitted by the O stars in the solar neighborhood.

To my family

"It is a miracle that curiosity survives formal education."

Albert Einstein

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