

Absolute Spectrophotometric Calibration to 1% from the FUV through the near-IR

Principal Investigator: Dr. David S. Finley

Institution: Eureka Scientific Inc.

Electronic Mail: david@eurekasci.com

Scientific Category: COSMOLOGY

Scientific Keywords: WHITE DWARFS, COSMOLOGICAL PARAMETERS AND DISTANCE SCALE,
DARK MATTER

Total Budget Amount: \$28,200 (Increase requested for HST-AR-10654)

Calibration: Yes

Abstract

We are requesting additional support to complete the work now being carried out under the Cycle 14 archive program, HST-AR-10654. The most critical component of that effort is an accurate determination of the STIS spectrometer LSF, so that we may correctly model the infill of the Balmer line cores by light redistributed from the wings and adjacent continuum. That is the essential input for obtaining accurate and unbiased effective temperatures and gravities, and hence calibrated fluxes, via line profile fitting of the WD calibration standards. To evaluate the published STIS LSF, we investigated the spectral images of the calibration targets, yielding several significant results: a) the STIS LSF varies significantly; b) existing observation-based spectroscopic LSFs or imaging PSFs are inadequate for deriving suitable spectroscopic LSFs; c) accounting for the PSF/LSF variability will improve spectrophotometric accuracy; d) the LSFs used for model fits must be consistent with the extraction process details; and, e) TinyTim-generated PSFs, with some modifications, provide the most suitable basis for producing the required LSFs that are tailored to each individual spectral observation. Based on our current (greatly improved) state of knowledge of the instrumental effects, we are now requesting additional support to complete the work needed to generate correct LSFs, and then carry out the analyses that were the subject of the original proposal.

Our goal is the same: to produce a significant improvement to the existing HST calibration. The current calibration is based on three primary DA white dwarf standards, GD 71, GD 153, and G 191-B2B. The standard fluxes are calculated using NLTE models, with effective temperatures and gravities that were derived from Balmer line fits using LTE models. We propose to improve the accuracy and internal consistency of the calibration by deriving corrected effective temperatures and gravities based on fitting the observed line profiles with updated NLTE models, and including the fit results from multiple STIS spectra, rather than the (usually) 1 or 2 ground-based spectra used previously. We will also determine the fluxes for 5 new, fainter primary or secondary standards, extending the standard V magnitude lower limit from 13.4 to 16.5, and extending the wavelength coverage from 0.1 to 2.5 micron. The goal is to achieve an overall flux accuracy of 1%, which will be needed, for example, for the upcoming supernova survey missions to measure the equation of state of the dark energy that is accelerating the expansion of the universe.

Investigators:

	Investigator	Institution	Country
PI	Dr. David S. Finley	Eureka Scientific Inc.	USA/CA
CoI	Dr. Ralph Bohlin	Space Telescope Science Institute	USA/MD
CoI	Dr. Ivan Hubeny	University of Arizona	USA/AZ
CoI	Dr. Claus Leitherer	Space Telescope Science Institute	USA/MD

Number of investigators: 4