

Calibration and Standardization of Large Surveys and Missions in Astronomy and Astrophysics



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A Balloon-Borne Light Source for Precision Photometric Calibration

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The ability of type Ia supernova surveys to distinguish among the various proposed theories of dark energy is presently limited by the need to reduce systematic photometry errors to significantly less than 1%. In pursuit of this goal, Stubbs and Tonry (2006) have proposed an approach to photometric calibration that deemphasizes celestial standards in favor of using a NIST-calibrated photodiode as the radiometric standard. We have successfully implemented this technique in calibrating instruments and in accounting for molecular extinction in the atmosphere. We report on the design of ALTAIR, a stratospheric balloon-borne instrument intended to directly measure the aerosol component of atmospheric extinction. ALTAIR lofts a calibrated, polychromatic light source well into the stratosphere, which, when observed from the ground with a dispersive imager, directly reveals the transmission function of the atmosphere at selected wavelengths. The light source employs a bank of laser diodes to excite an integrating sphere which precisely maintains the luminosity ratios among colors across all viewing angles. An onboard photodiode with NIST-traceable sensitivity function monitors the source luminosity.

Summary

The design and construction of a high altitude balloon-borne light source for calibrating out the effects of the atmosphere, and providing Ia supernova photometry beyond the 1% level.

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