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This Week's Citation Classic

Landolt A U. *UBV* photoelectric sequences in the celestial equatorial selected areas 92–115. *Astronomical J.* 78:959-81; 989-1020, 1973.
[Louisiana State University Observatory, Baton Rouge, LA]

This paper provides new *UBV* standard stars on an internally consistent homogeneous system around the sky, at the celestial equator, and easily accessible to large telescopes in both hemispheres. [The *SCI*® indicates that this paper has been cited in over 290 publications.]

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Astronomical photometry is the observational aspect of astronomy that deals with the measurement of the energy radiated by celestial objects at any point or points along the electromagnetic spectrum. The measured intensities of celestial objects are described by units called magnitudes.

The first attempts to assign brightnesses to celestial objects are lost in antiquity. Hipparchus, an astronomer of the second century B.C., distributed the stars visible to the naked eye into six groups called magnitudes. The brightest stars visible to the naked eye were placed into the first magnitude category; those just visible were said to be of magnitude six. It was not until 1856 that N.R. Pogson suggested the now-accepted quantitative scale of stellar magnitudes. A difference of five magnitudes in the brightnesses of two celestial objects corresponds to a ratio of 100 in their luminous flux.

What is generally accepted as the first published collection of stellar brightnesses appeared in the *Almagest*, authored by Ptolemy about 150 A.D. His results, of course, were based on human naked-eye estimates of the brightness of stars. One can obtain differently characterized brightnesses of a celestial object if that brightness is measured through a certain filter whose bandpass permits the passage of radiation from a specified section of the electromagnetic spectrum. The difference in the measured fluxes, or magnitudes, at two different wavelengths is called an object's color index.

As one might expect, the accuracy with which one knows the brightnesses and colors of celestial objects has increased with the passage of time as new techniques have become available. Around the turn of this century, photography supplanted the naked-eye data of all previous ages. The next great change appeared at the end of World War II when photomultiplier tubes became available as a still more efficient method of recording incoming radiation from space. The most recent five years or so have seen the advent of charge-coupled devices as a new way to detect radiation with still greater efficiency and eventually accuracy.

Each detection technique demands the availability of calibrators with which one can standardize the measurements of flux at specified wavelengths. Modern calibration efforts began with the work of Harold L. Johnson[1] some 35 years ago. The standard star work that I have done over the past 20 years or so has been based upon the foundations established by Johnson and others.

The data collection for my highly cited standard star research took place at the Kitt Peak National Observatory (KPNO), located southwest of Tucson on the sacred mountain of the Papago Indian tribe. The KPNO is one of two national optical observatories funded by the US National Science Foundation. The second is the Cerro Tololo Inter-American Observatory (CTIO), located in the foothills of the Andes Mountains some 40 miles inland from the Chilean coastal city of La Serena. Both observatories exist to provide US astronomers with world-class optical observational opportunities, one in each hemisphere. Both sites are of excellent quality, with the CTIO site being one of the best ground-based astronomical locations on earth.

The work acknowledged here is the basis for a more recent list of standard stars[2] and for additional lists in preparation. These more recent data have been collected almost entirely at the generally exceptionally clear skies of the CTIO. Most encouragingly, my past and ongoing broad-band standard star work has been adopted as the definitive calibrating sequences for instrumentation aboard the Hubble Space Telescope, whose launch will, it is hoped, occur in the not too distant future.

1. **Johnson H L & Morgan W W.** Fundamental stellar photometry for standards of spectral type on the revised system of the Yerkes spectral atlas. *Astrophysical J.* 117:313-52, 1953. (Cited 950 times since 1955.)
2. **Landolt A U.** UBVRI photometric standard stars around the celestial equator. *Astronomical J.* 88:439-60, 1983. (Cited 90 times.)