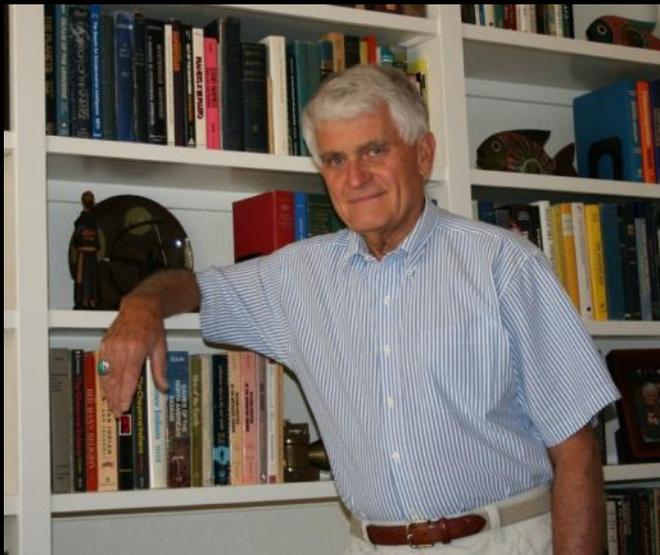
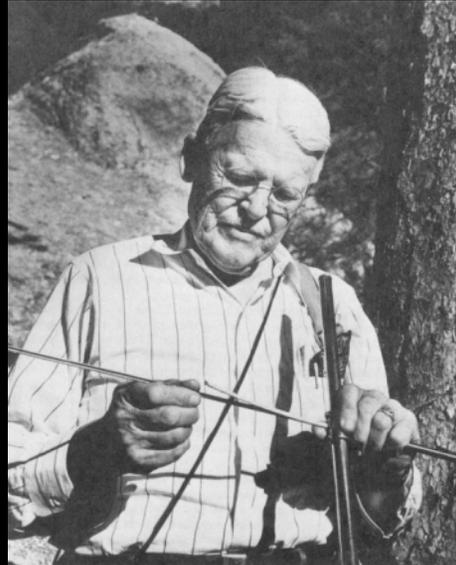


Solar Variability After Dark

Photometric evidence and some dead ends from stars and planets

Wes Lockwood, Lowell Observatory

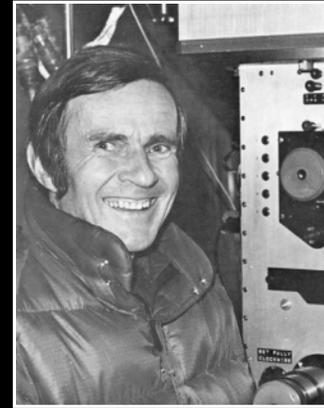
A curious connection



What followed in six weeks of March and early April of 1894 was a comic opera of a one-man, whirlwind site-survey – made by rail and horse-drawn wagon with a small telescope and a large stack of Western Union Telegraph blanks, the latter to keep his anxious employer advised, in real time, of nightly measures of the skies.

---book review by Jack Eddy

Getting started 1950



DIRECT PHOTOELECTRIC PHOTOMETRY (Measurements for Solar Variation)

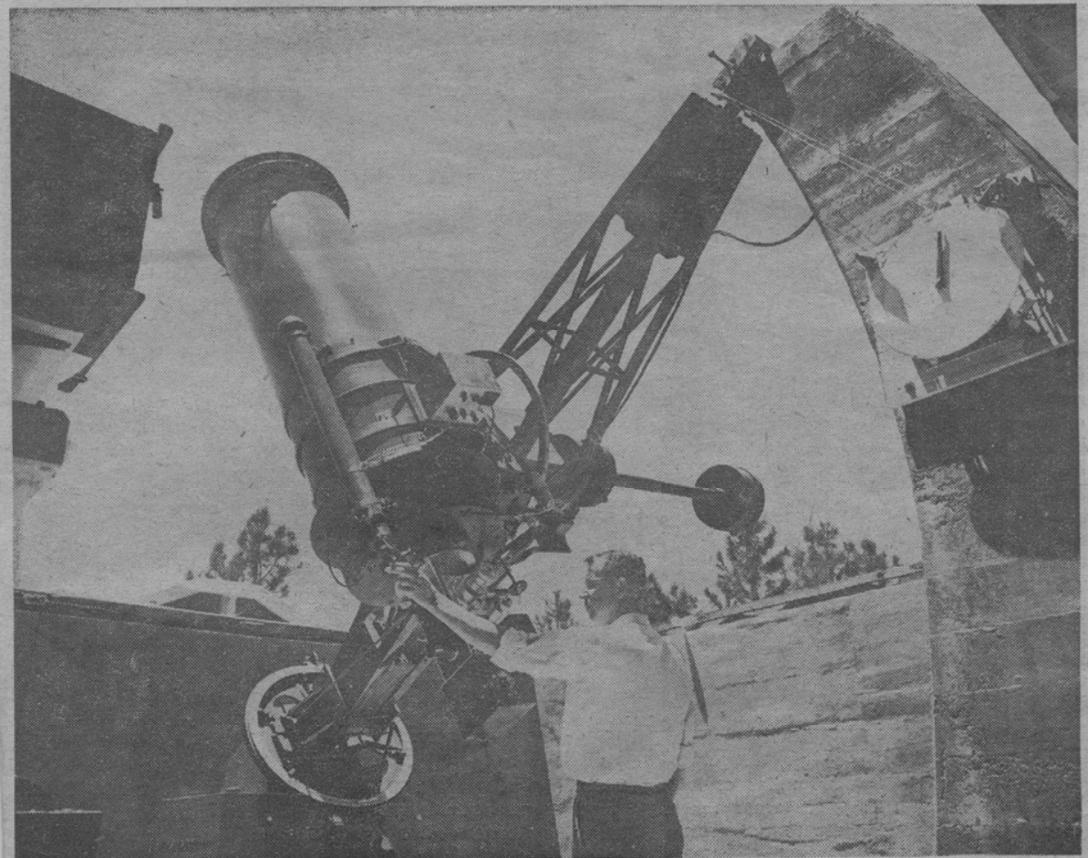
By Henry L. Giclas

Abstract of Previous Work: The brightness of Uranus, Neptune, and certain minor planets have been observed in selected spectral regions with the photoelectric photometer attached at the Cassegrainian focus of the 42-inch Lowell reflecting telescope. These objects, depending upon the sun for their light, have been referred to the light of stars as extra-solar standards. The results are to be examined for the size and character of any variations from the standpoint of possible cause from solar variation, and may be compared with the Smithsonian determinations of the solar constant for possible correlation of changes when these latter values become available.

In the beginning



Lowell's New Telescope To Train On Sun's Light



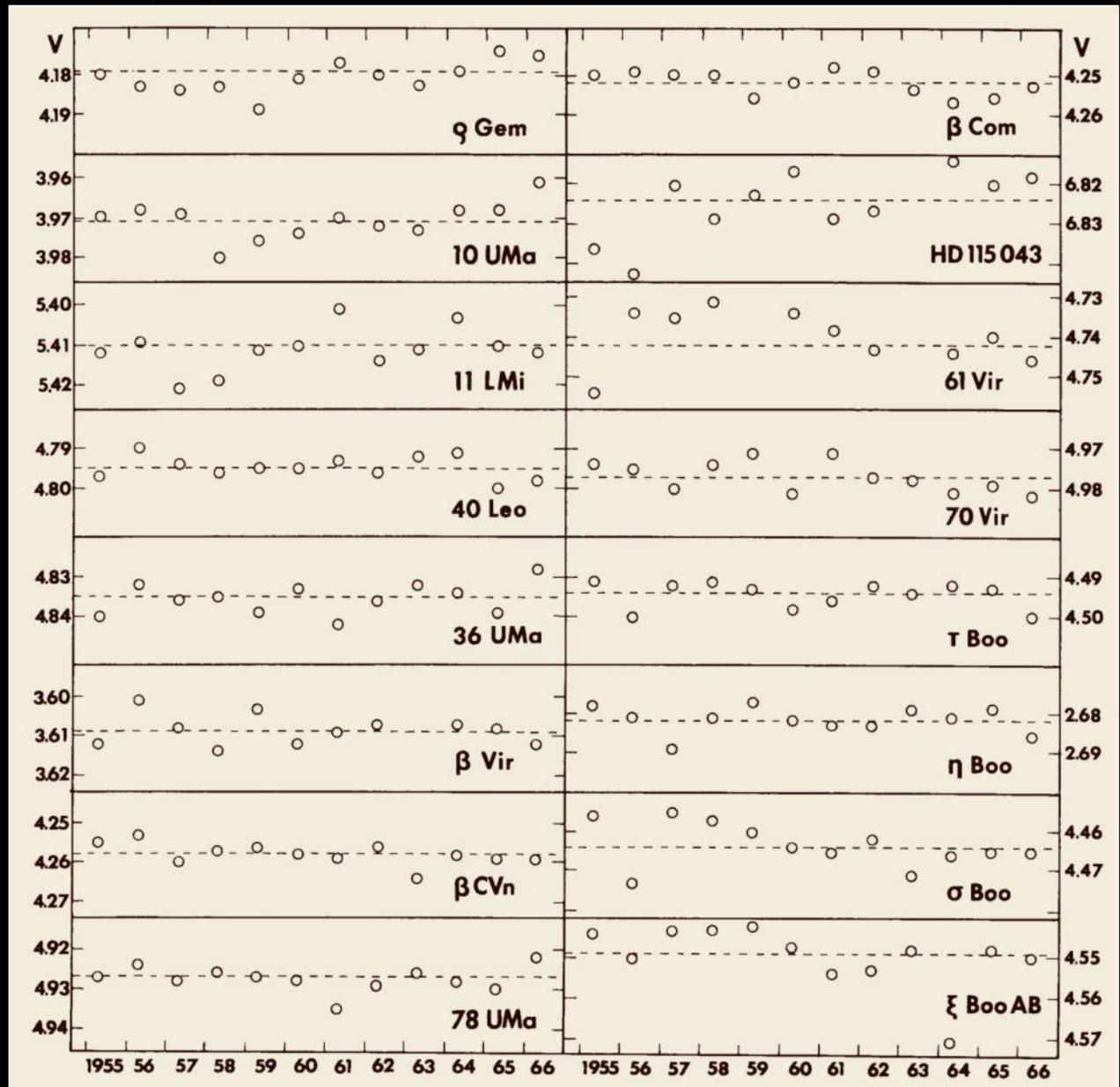
Henry Giclas, Lowell Observatory astronomer, checks the newly-installed 21-inch telescope.

FLAGSTAFF

1966: What they learned

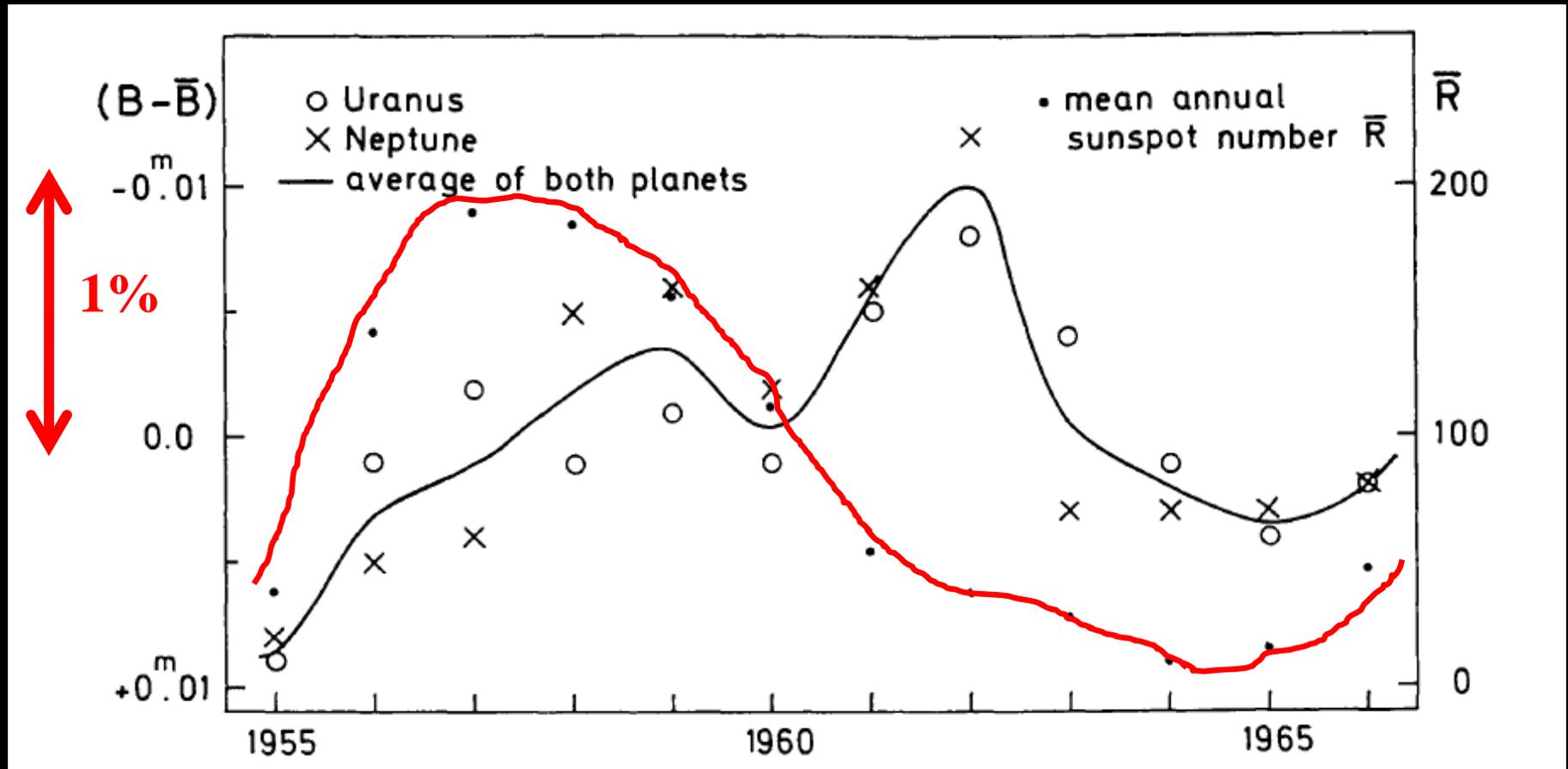
”If we assume the sun acts in similar fashion to each of these stars, its variability over a 15-year period probably does not exceed one half of one percent.“

*Jerzykiewicz and Serkowski, 1966
Lowell Observatory
Bulletin*

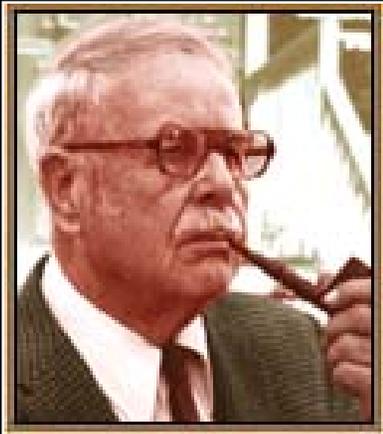


Planets and the solar cycle

D. Labs looks for a sun-planet correlation in the Lowell planetary data



1967: Olin C. Wilson's great idea



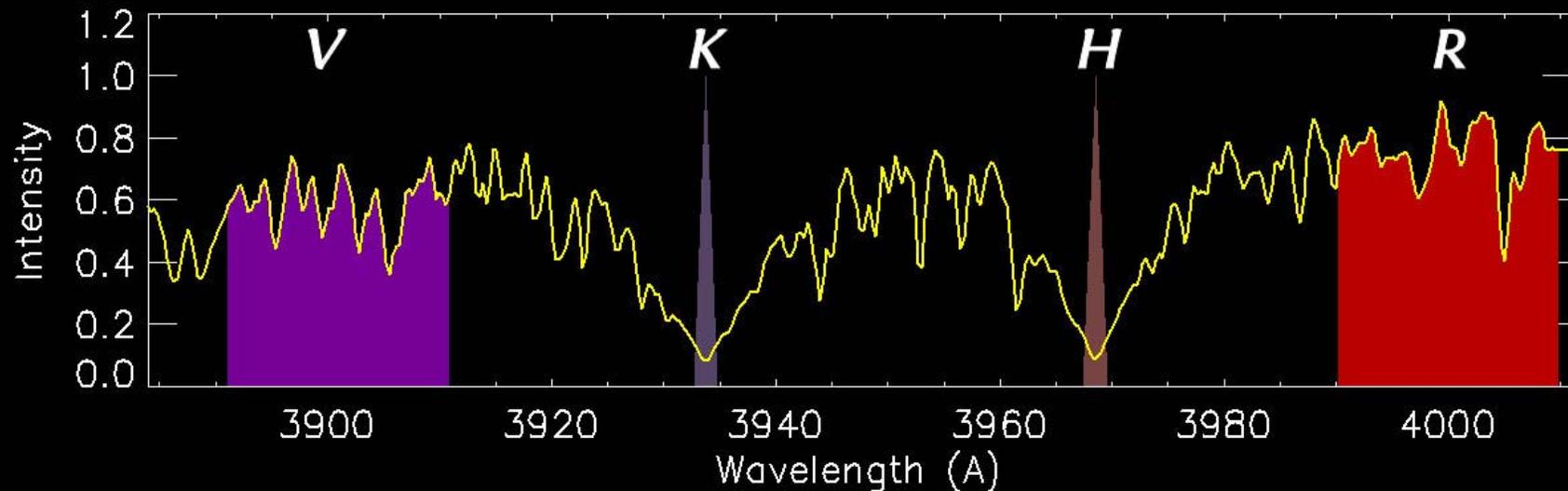
FLUX MEASUREMENTS AT THE CENTERS OF STELLAR H- AND K-LINES

O. C. WILSON

Mount Wilson and Palomar Observatories, Carnegie Institution of
Washington, California Institute of Technology

Received November 13, 1967

If Sheeley's results are correct, and if other stars exhibit similar amplitudes of H-K emission, the observational problem of finding stellar cycles should not be too difficult.



1978-2000: Wilson's project continues

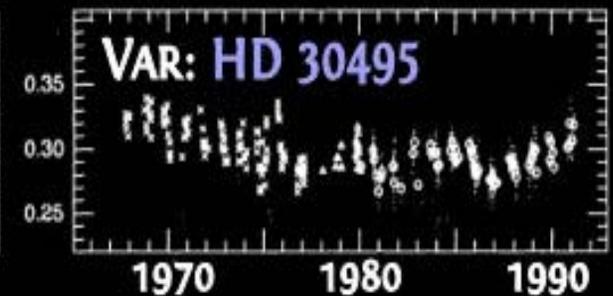
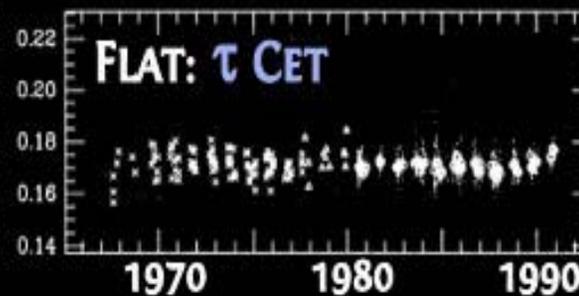
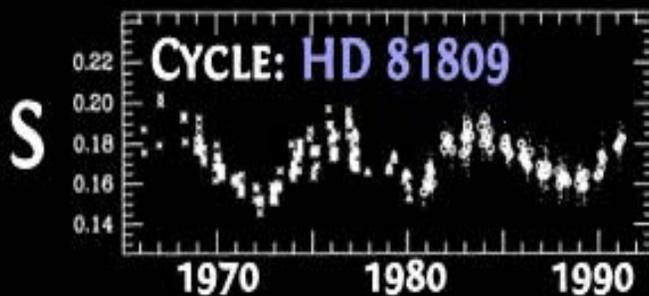


Three main kinds of variability:

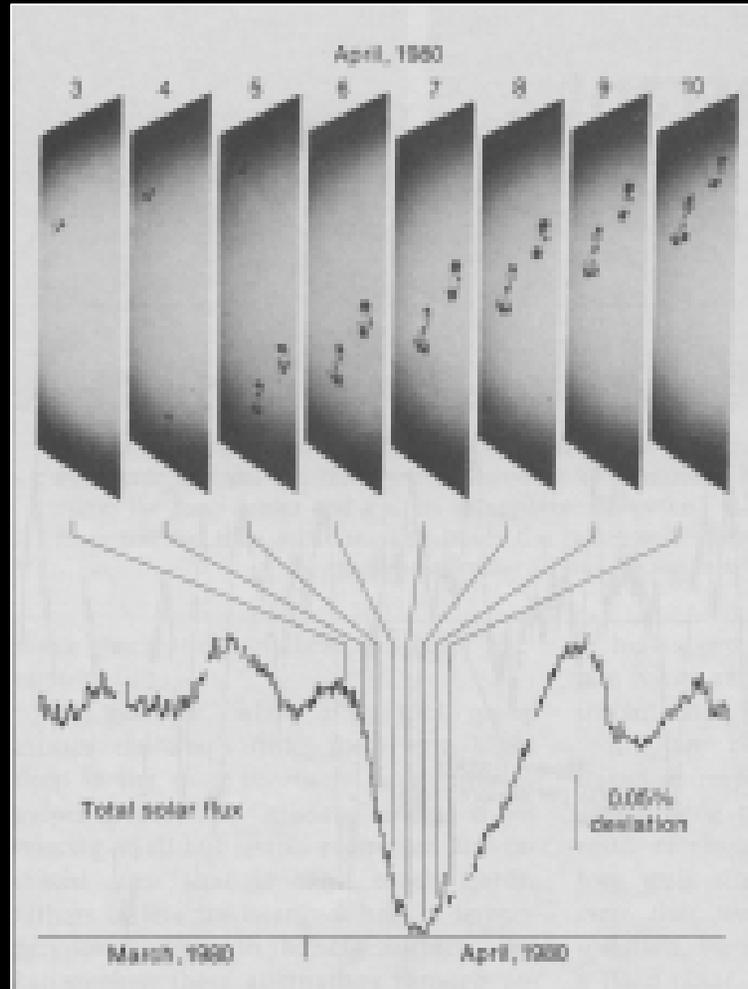
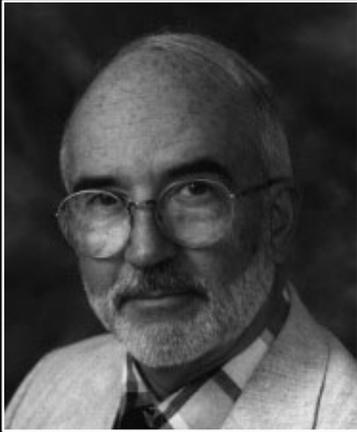
Cycles (!)

Flat

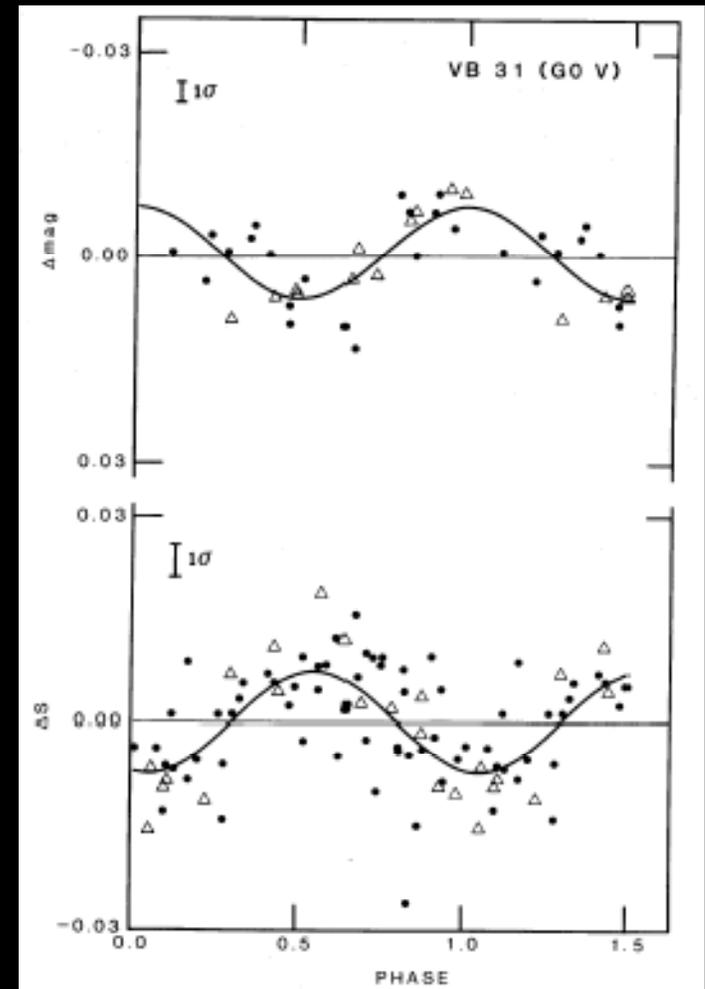
Noisy



Spots dim the sun and the stars

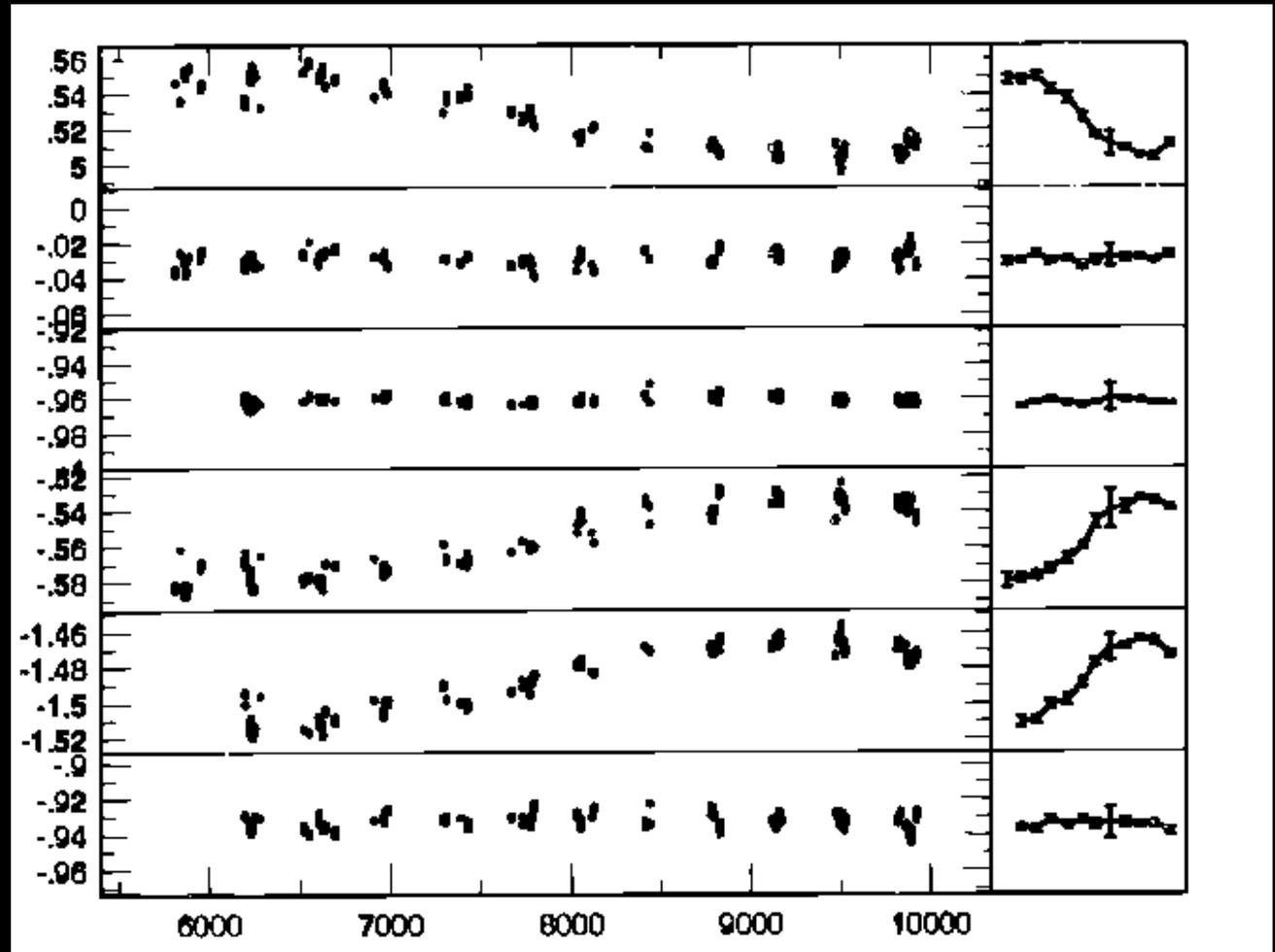
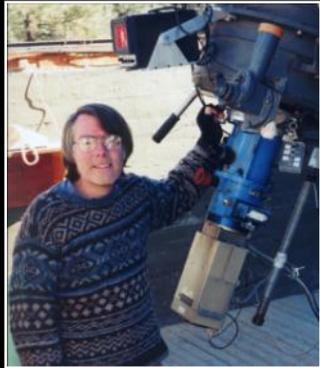


Sun, from Solar Max Mission



A star with spots, from Lowell and Mt. Wilson

1984-2007: Measuring sunlike stars



night by night

yearly avgs

Lowell's "SSS" project

Solar Stellar Spectrograph



Robotic photometry at Fairborn



Lou Boyd, input

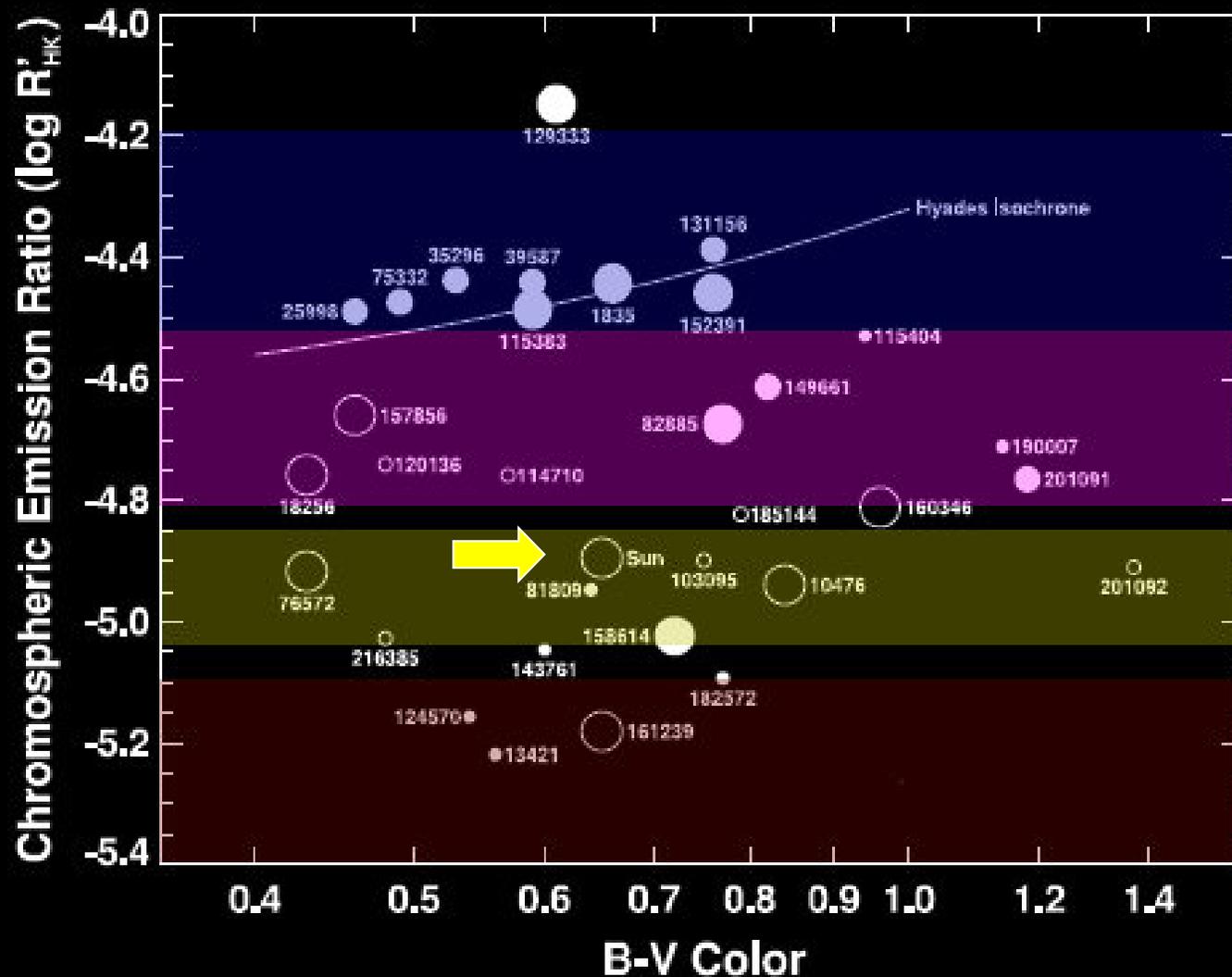


Greg Henry, output



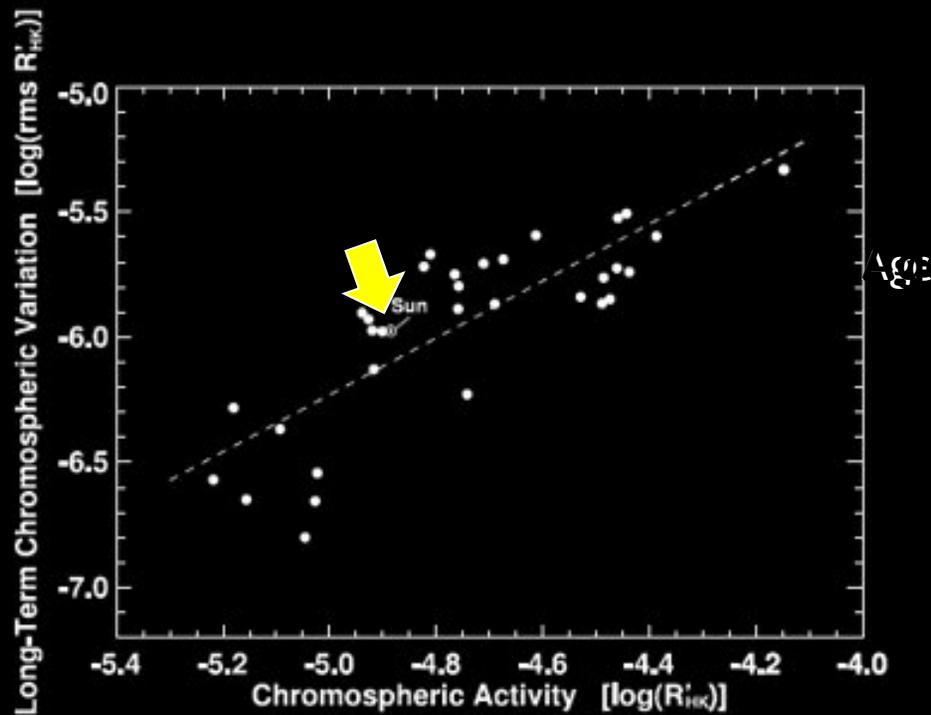
Tennessee State Univ. telescopes at Fairborn Observatory

Variations of Sun-like stars

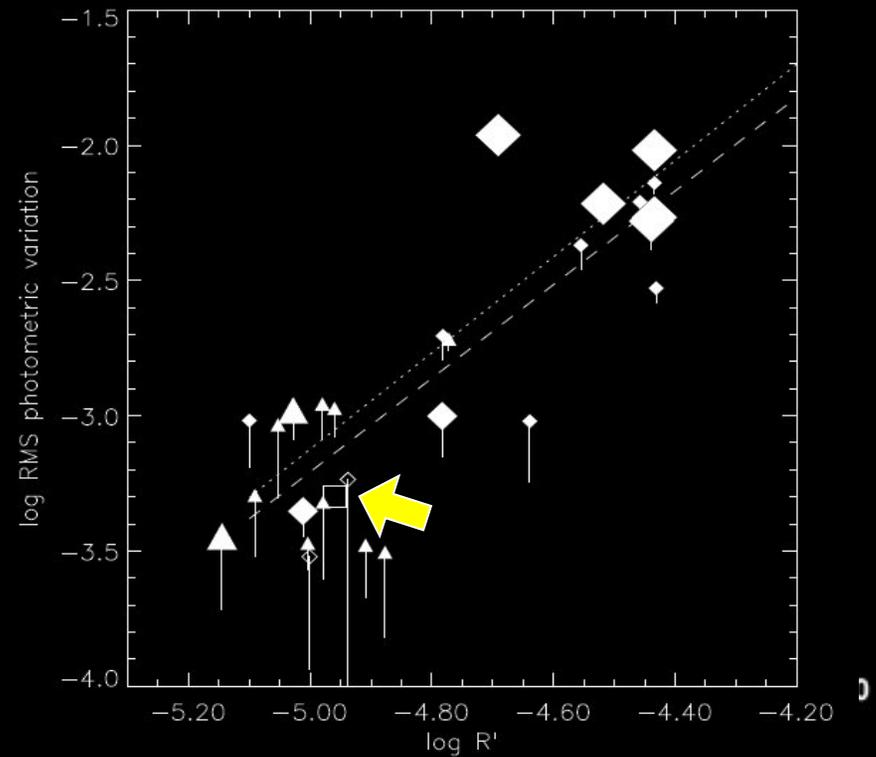


Activity-brightness correlations

HK activity



brightness variation



← Age

What's next ?

The Lowell SSS project and the Fairborn APT photometry project continue to characterize variability among the closest solar analogs (“solar twins”).

We seek evidence of “grand minima” like the Maunder Minimum.

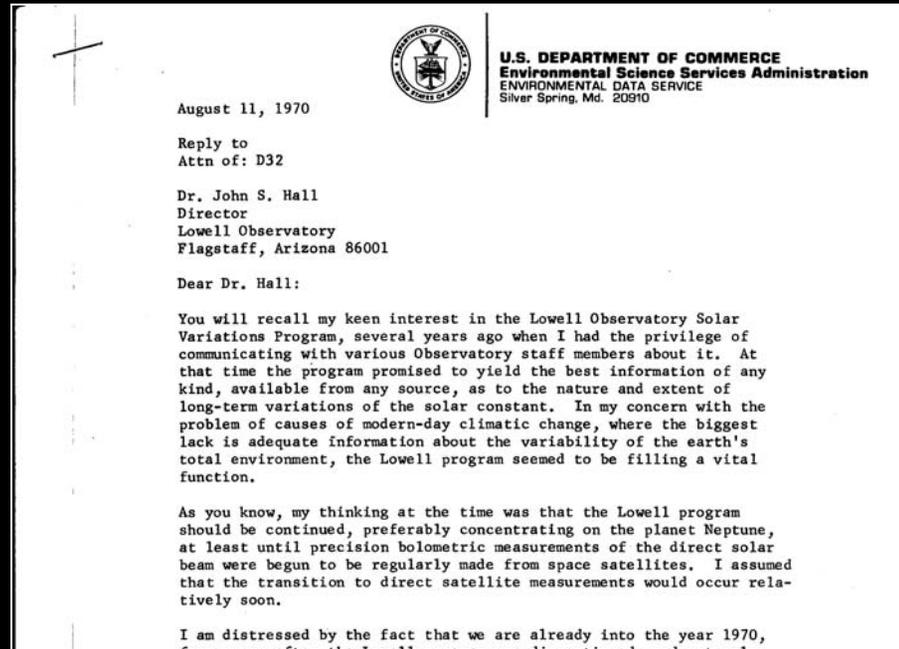
Kepler may reveal portions of low level solar-like activity cycles (but for only 4 years).

And...finally, after 1971, the remnant of the planetary photometry continues, now in its 61st year, mapping out seasonal variations of planetary albedo.

1970: J. Murray Mitchell. Jr. writes...



Scanned at the American
Institute of Physics



I am distressed by the fact that we are already into the year 1970, four years after the Lowell program was discontinued, and not only do we not yet have the satellite measurements in question but the latest NASA schedules do not show them beginning until at least 1972 and probably 1973 or 1974. In the meantime we have no even half-way reliable information on the solar constant, except a few months of

Uranus and Neptune over 60 years

60 years of Lowell photometry produces surprises and a unique long-term record for planetary science.

