the general lack of alternatives with appropriate period
light-curve, and color behavior.

Modern photoelectric determinations of spot proper-
ties appear to favor spot temperatures a few hundred
degrees cooler than the surrounding photosphere, but the
results are not unique, and bright spots may also be
present. Suggestions that spots may trace out differential
rotation have come from the observed migration of the
light curve with respect to the eclipses in RS CVn
stars, and from period changes in dwarfs; however, it is
not clear whether the period changes reflect differential
rotation or spot evolution.

Spot variability may occur on timescales of days.
However, photographic studies with a time baseline ~ 60
years, completed for four dwarfs, show long-term drifts
in optical light on the order of 3%, with timescales of
decades. No real evidence for 11 year cycles has been
found, in contrast to Wilson's Ca II emission observa-
tions, but this discrepancy may be due to the limited
accuracy of photographic plates. Similar kinds of be-


cavior are present in RS CVn stars; spot areas may per-
sist for periods up to decades.

Standard spot models translate the 30% optical vari-
ability into ~ 10% luminosity variations; this should
be confirmed by bolometric observations. The available
long-term studies and statistical arguments suggest that
variability may be intermittent. The long timescales
present in the observations indicates that suppression
or modification of convection in the outer envelope per-
sists for timescales longer than the overturning time.

Session 14: 1000–1200 (Room 277)
X-Ray Pulsars

03.14.09 Observations of the Vela Pulsar from the
Einstein Observatory. F. R. HARNDEN, JR., P. HERTZ,
F. GORENSTEIN, J. GRINDLAY, E. SCHREIER, and F.
SEWARD, Harvard-Smithsonian Center for Astrophysics. *

The Vela pulsar (PSR 0833-45) has been observed with the
two imaging detectors of the Einstein Observatory. The
1.5 x 2.5 field observed with the Imaging Proportional Counter
is filled with soft emission (0.1 - 0.28 keV) from the Vela
SNR and also contains a discrete source of harder emission
(0.5 - 3.0 keV) at the position of the pulsar. No X-ray
pulsations at the radio period were detected in the data
obtained 1978 November 28 and December 20–25, with a
95% confidence upper limit of 2 x 10^{-15} erg cm^{-2} sec^{-1}.

A comparison between this field and others within the 9
Vela supernova remnant suggests that the pulsar is
fortuitously located near a hot spot in the blast-wave emission
from the large scale remnant. The High Resolution Imager
(HRI) picture reveals a small scale nebula of ~ 80 arc sec
extent centered on the pulsar, with the emission strongly
peaked at the position of the pulsar. This detailed
structure will be discussed in the context of models of
hot neutron star emission and pulsar-nebula interactions.

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04.14.09 X-Ray Observations of a 38 sec Pulsar:
F. R. HARNDEN, JR., P. HERTZ, T. DUTY, S. K. BURKE, P. LANG,
A. M. LEVINE, F. A. PRIMINI, W. A. WHALEN, W. H. LEWIN,
MIT, D. E. GRUBER, J. L. MATTeson, L. E. PETERSON, UCSB.—
A 38 sec pulsar was observed from 13-40 keV during an

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