COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 918

Konkoly Observatory
Budapest
1974 August 21

ON THE VARIABILITY OF π PsA

π PsA was pointed out to be a Cepheid variable by Strohmeier et al. (IBVS 86, 1965), who assigned a period of $7^d.975$ and a small amplitude ($A_{pg}=0^m.3$). Kukarkin et al. (GCVS 1970) still quote these characteristics in the edition of the GCVS. Buscombe and Morris (MN 123, 183, 1961) found the star to be a single-lined spectroscopic binary with $p = 356^d.567$, and Gliese's (Heid.Ver.22,1969) data read as follows:

$V= 5^m.10$, $B-V = +0^m.29$, $(U-B)_c = +1^m.56$

$\mu_\alpha= 0".071$, $\mu_\delta= 0".085$, $\pi = 0".050 \pm 0".010$ (p.e.)

Spectral type : FO IV - FO V (IBVS 680, 1972)

New observations by Bopp et al. (MN 147,355,1970) led to a revision in star's orbital period : $P = 178^d.3177 \pm 0^d.0038$ (p.e.) .The measured γ velocity was 6km/s. Gliese's proper motion data were retained, and for the parallax a value $\pi = 0".044$ was given. These authors found systematic deviations of old radial velocity measures from the computed curve, which they suggest may indicate the presence of a third body in the system.

More recently, Petit (IBVS 680 and 695, 1972) argued against the Cepheid nature of the star by saying that it could hardly be a δ Cephei variable if the proper motion and luminosity class were to be confirmed. He has also mentioned the recent UBV observation by Corben et al. (MNASSA 31,7,1972), which agrees whith Gliese's data and led to $U - B = -0^m.01$, thus confirming the above quoted $(U - B)_c$ value (see Cousins and Stoy, (RO Bull.64,1963), for the $(U-B) - (U-B)_c$ relation).

π PsA was included in a program of five-color photometry (Lick's UVBGR, ApJ 98,20,1943) of southern Cepheids performed during 1970 at the ITA Astronomical Observatory S. José dos Campos, Brazil. No variability has been detected within $0^m.02$ in light and color, and the UBV data has been confirmed (Astr.Aph. 1974, in press).

Our intention here is to throw some more light on the problem, and to call attention on some properties of this star which, we think deserves further examination.

From Bopp et al's parallax we deduce that the star is at a distance of 23 pc, which gives $M_v \simeq + 3^m.3 \pm 0^m.5$ assuming an error of $\pm$ 0".010 in π. In comparing its M_V, (B - V) and (U - B) values with the new standard data of Allen (Astr.Quant. 3rd ed.204 and 206, 1973) for main-sequence stars, we note that:

a) The (B - V) index and the absolute magnitude are typical for a F1V unevolved object.

b) The star has a (U - B) excess of about $0^m.06$.

π PsA figures in Lindeman and Hauck's (Astr.Aph.Suppl 11,119, 1973) uvbyβ catalogue with the following characteristics:
b - y = $0^m.200$, $m_1 = 0^m.159$, $c_1 = 0^m.690$ and $\beta = 2^m.741$.
From these, some conclusions can be reached:

1) Its position in the $\{m_1\}$ - $\{c_1\}$ diagram by Strömgren (Ann. Rev.Astr.Aph. 4,433,1966) is in good agreement with the assigned F0V spectral classification. The star lies near the ZAMS line in Crawford et al's (Astr.Aph.Suppl.5,109,1972) (b - y) - c_1 plot.

2) Its β, (b - y) and c_1 values are typical of A star, according to the calibration by Crawford (IAU Coll. "Stellar Rotation" 204,1970). The metallic line index m_1 indicates, however, metal-content deficiency relative to the Hyades stars ($\Delta m_1 = + 0^m.022$), confirming the (U - B) excess referred to above.

3) From Crawford's M_v (β) calibration one gets $M_v \simeq 2^m.7$ (rms= $=0^m.3$), which agrees statistically with the values calculated from parallax measures.

4) The iron-hydrogen ratio can be estimated from the m_1 - $\{F_e/H\}$ relation by Stromgren (In Vol 3.Ch.IX of Stars and Stellar Systems, 1963), for F-to-late G main sequence stars. For π PsA, one gets $\{F_e/H\}$ = = 0.076 (rms = 0.15). Thus, in terms of metal-content one can also verify that the star in far from having Cepheid characteristics.

If the star's variability is real (the only reference about it being that of Strohmeier et al.), the amplitude, absolute magnitude and colors would rather be suggestive of δ Scuti or AI Velorum "dwarf Cepheids" types. Baglin et al's (Astr.Aph.23,221,1973) data on these short-period variables can help to test the hypothesis. Some brief conclusions are reached:
- from the P - ΔC_1 relation one might expect for π PsA ($\Delta c_1 = 0^m.03$) a fundamental period of about $0^d.05$.
- it is near the instability strip in the M_v - (b-y) diagram, if we take $M_v = 2^m.7$, as suggested by uvbyβ data.

-its metallic line index m_1 is somewhat smaller than that expected for a main sequence δ Scuti object, as can be seen from the m_1-(b-y) plot.
-the observed discrepancies by Bopp et al. in radial-velocity curves could be explained by beat phenomena and variations of amplitudes, frequently present in δ Scuti stars.

It seems, therefore, most probable that π PsA is not a classical Cepheid variable. New accurate observations are needed to check a possible small-amplitude variation (a few hundredths of magnitude, at most), to solve the differences in the M_V calculations and to determine the nature of the systematic discrepancies of radial velocity measurements mentioned by Bopp et al.

São Paulo, maio de 1974

E. JANOT PACHECO
Instituto Astronómico e Geofísico
Universidade São Paulo