IN THE RECENT JOURNALS

A summary of selected articles on variable stars published during the latter part of 1977.

Astrophysical Journal

"Cepheid Studies. I. Mode Interaction in the Beat Cepheid U Trianguli Australis," by D.J. Faulkner (216, 49-56).

More than a dozen cepheid variables have light curves which display two well-defined periods, P_1 and P_2. The values of P_1 range from 0.7 days to 6.3 days, and the ratios P_1/P_2 for these stars are remarkably similar -- all are nearly 0.71. (Two cepheids, AC And and TU Cas, show three such periods.) These "beat cepheids" are assumed to be pulsating in the first harmonic as well as the fundamental modes, and a study of P_1 and P_2 can lead to masses for these stars. Comparisons of the masses derived this way with masses derived from stellar evolution arguments have led to serious discrepancies: the "beat masses" are only one-half the "evolutionary masses."

Faulkner's aim was to determine whether the beat masses are being derived incorrectly from available theory. He shows, from a Fourier analysis of the light curve, that the component light curves of this star do not add in a simple way, and that there is a marked interaction between the modes. This suggests that the beat masses may be incorrect, but Faulkner comes to no definite conclusion.

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"Comments on the Light Curve of the Quasar 3C273," by L. M. Ozernoy, V. E. Chertoprud, and L. I. Gudzenko (216, 237-243).

This is the brightest of known quasars and, as is typical of quasars, its light varies irregularly over periods of days and months. Two interpretations have been suggested: (a) the light curve is produced by variations of a single object; and (b) it is the result of superposed pulses of light arising at random, for example, through stellar collisions or explosions in large groups of stars. These authors (who all work in Moscow, U.S.S.R.) show that an earlier statistical study supporting (b) is incomplete. They argue that (a) is the more plausible alternative.

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"Coordinated X-ray, Optical, and Radio Observations of YZ Canis Minoris" (216, 479-490).

This paper reports on an international monitoring of the flares of this UV Ceti star by twenty-seven co-authors. Thirty one optical flares and eleven radio events were detected and, although no flare-related x-ray events were recorded, this fact, alone, permits elimination of several theoretical models.

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"Spectroscopic Studies of Nova V1500 Cygni. I. The 3 hour periodicity and Nebula, " by J. B. Hutchings and M. L. McCall (217, 775-780).

Analyses of the copious data on this bright, summer nova of 1975 have begun to appear, and the nova seems unique in several ways. It was the fastest known galactic nova, and hence presumably the brightest in absolute terms. It has the largest known range of light, having been invisible on the pre-eruption Palomar Sky Survey prints. It showed brightness fluctuations with a period of 3 hours, both in the continuous spectrum and the shapes and intensities of its emission lines. These fluctuations were discovered a few days after maximum and persisted for at least ten months. Thus far, they are unexplained, but the authors of this paper argue that they may best be explained by a "search-light" model in which light from an accretion hot spot, rotating with a period of 3 hours, sweeps around the expanding nebula. This model appears capable of explaining the detailed variations, but direct evidence for a binary system is still lacking, although the generally accepted theory of galactic novae supposes all such stars to be in binary systems.

Publications of the Astronomical Society of the Pacific

"A Magnetic Field Interpretation for the Outburst of CH Cygni," by T. J. Wdowiak (89, 569-571).

Earlier spectroscopic studies of the M6 symbiotic star indicated that the outbursts take place in a single star, because there is no evidence for orbital motion. The author suggests that the abrupt heating of the atmosphere may be caused by the emergence of large-scale magnetic fields, carried up by convective motions in the envelope. A rough quantitative estimate shows that the time-scales are appropriate, and the author asks for further observations of the star's magnetic field, to confirm or deny an earlier, tentative detection.

Astronomy and Astrophysics

"An Eccentric Close Binary Model for the X Persei System," by H. F. Henrichs and E. P. J. van den Heuvrel (54, 817-822).

X Per is an irregularly variable sixth-magnitude, hot main-sequence star that has been identified with an x-ray source. It shows broad hydrogen emission lines (implying a rotational velocity of 400 km/sec), and the centers of these lines shift with a period of 581 days. In an earlier study, it had been assumed that these shifts were due to orbital motion, and this assumption led to a mass greater than 30 solar masses for the unseen companion -- therefore assumed to be a black hole. The present authors point out that the behavior of this star can be understood equally well in terms of the "classical" model for x-ray binaries: a neutron star in orbit about a hot star ejecting gas. They note that the intensity of the x-ray emission shows two distinct periods: a 40 percent variation with a period of 13.9 minutes, which they attribute to pulsation of the neutron star, and a 20 percent variation with a period of 22.4 hours, which they attribute to the neutron star's orbital motion about the primary component. They suggest that the orbit is eccentric and that the 581 day period of the hydrogen lines is due, not to orbital motion, but to a rotation of the long axis of the orbit ("apsidal motion"). Thus, the quest for sure proof of a black hole still goes on.

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"Elements and Intrinsic Variability of VZ CVn", by B. Cester, F. Mardirossan, and M. Pucillo (56, 75-81).

The authors derived times of minima for this eclipsing binary and find P = 0.84246163 days for the interval 1971-1976, with no sign of variability. A new solution for the photometric elements using 3-color data of 1976 and a computer simulation of the light curve gives a circular orbit and stars that are slightly elliptical but well separated from each other.

This system is remarkable for its residual light variations of 0.1 magnitudes. These variations are not short-term, because the light curve on a single night is quite smooth, but the level changes from one night to another. There is no evidence in the spectrum for mass exchange, and the authors suggest that one (or both) of the components may be variable.

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"Characteristics of H_2O emission from Mira Variables," by J. R. D. Lepine and M. H. Paes de Barros (56, 219-226).

"Steam" radiation, resulting from maser action by the infrared light of the star, varies cyclically with the light curve of some Mira variables. The authors show that the maximum strength of the H_2O emission varies little from star to star, and that the stars in which the radiation has been detected happen to be closest to the Earth.

Estimates of the mass-loss per star, $2x10^{-7}$ solar masses per year, and of the total number of Mira variables, indicate that these stars are the main contributor to the mass of the interstellar medium.

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"CV Velorum, Light Curves, Photometric Elements and Absolute Dimensions," by J. V. Clausen and B. Grøbech (58, 131-137).

The double-lined eclipsing binary, CV Vel (Sp = B2.5V), had previously yielded an unusually precise mass-determination from radial-velocity measures, and the present authors combine 1044 four-color measures, obtained with the Copenhagen 50-cm. telescope in Chile, to derive precise photometric elements. Each star has a mass of 6 solar masses, a radius of about 4 solar radii, and T = 18,200°K. A comparison with theoretical stellar models shows that the components are slightly evolved and have ages of $3x10^7$ years.

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"Short Periodic Oscillations of the Dwarf Nova VW Hydri," by R. Haefner, R. Schoembs, and N. Vogt (61, L37-L38).

Dwarf novae are known to show short-period oscillations (0.01 mag. with periods about 16 to 35 seconds) around the time of maximum brightness, but VW Hydri is unique in showing a period of 87 seconds. This star is characterised by short eruptions repeating every four weeks and "supermaxima" repeating every six months or so. The 87-second oscillations were detected after a supermaximum, when the star had declined 2 magnitudes. As a possible cause for the oscillations, the authors rule out pulsations of the white dwarf (thought to be the explanation of the shorter oscillations in other dwarf novae) and argue for large bright irregularities that are carried around the accretion disc surrounding the white dwarf.

C.A.W.