

## PULSATIONAL PROPERTIES OF GP AND

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We have carried out simultaneous *uvby- $\beta$*  photometry for the high amplitude  $\delta$  Sct star GP And. Periodograms for this star have been constructed using the Discrete Fourier Transform method. The classical O-C method has also been used to study the stability of the fundamental pulsation. It is found that the pulsation of this star can be well described by means of a quadratic ephemeris with the period increasing at a rate of  $(1/P)(dP/dt) = 13.0(\pm 2.8) \times 10^{-8} \text{ y}^{-1}$  over the last nineteen years. Intrinsic *b-y*,  $m_1$  and  $c_1$  values are derived and the physical parameters of this star are determined.

VLA OBSERVATIONS OF CYGOB2 No. 5:  
DETECTION OF A WEAK RADIO COMPANION  
AND NEW OBSERVATIONS AND MODELS  
FOR THE MAIN COMPONENT

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We present Very Large Array observations of the contact binary star Cyg OB2 No. 5 obtained over the last four years. A weak ( $\sim 0.6$  mJy at 6-cm) radio companion has been detected  $\sim 0''.8$  to the NE of the known main radio component. However, most of the radio continuum and the variability appear to be associated with the main component (that coincides in position with the optical contact binary). The centimeter continuum emission of the main component increased in 1989–1992 to levels similar to those observed in 1983–1986. The radio emission seems to alternate between a “low” and a “high” state with a period of about seven years. We derived its brightness temperature from 3.6-cm observations during “high” state, obtaining  $T_B = 100\,000 \pm 30\,000$  K. This large value rules out a possible thermal origin for the radio continuum emission. Several models are discussed to account for the characteristics of the radio emission from the main component. The most satisfactory consists of a synchrotron-emitting envelope produced near the outer region of the free-free radio photosphere ( $\sim 10^{15}$  cm at cm wavelengths).

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PERIOD VARIATIONS AND DUPLICITY  
OF THE  $\delta$  SCUTI STAR VZ CANCRI

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New photoelectric photometry and new times of maximum light are reported for the  $\delta$  Scuti-type star VZ Cnc. Times of maximum light available for the last five decades have been studied. They show a very suggestive sinusoidal variation with a period of about 18000 days (49.3 yrs.) and an amplitude of 0.0053 days. As an explanation, light time effects in a binary system are preferred over non-linear combinations of pulsational frequencies since the former is simpler, while the latter lacks numerical and theoretical grounds. Also other fits of the (O-C) diagram have been considered such as abrupt period changes or a sloping linear fit. However they were found unrealistic and less significant than the sinusoidal fit. If the binary interpretation is further investigated one could conclude that the putative companion would be a white dwarf or a main sequence star with  $M_2 \leq 1 M_\odot$ . It is stressed that the predicted amplitude variation due to orbital motion is only  $1.1 \text{ km s}^{-1}$  thus very difficult to detect due to its long time scale and to the presence of the  $40 \text{ km s}^{-1}$  variation due to the pulsation of the primary star.

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THE INTERPRETATION OF OBSERVATIONS  
OF ICE AND SILICATE IR FEATURES AND  
POLARIZATION ACROSS THEM IN THE  
SPECTRA OF PROTOSTELLAR OBJECTS  
BN AND AFGL 2591

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Calculations of dust absorption features of ice ( $\lambda = 3 \mu\text{m}$ ) and silicate ( $\lambda = 10 \mu\text{m}$ ,  $20 \mu\text{m}$ ) are presented, including the linear polarization across the features. An interpretation is made of observations of the protostellar objects Becklin-Neugebauer (BN) and AFGL 2591.

The dust model considered consists of a power-law size distribution of spinning spheroidal grains, which are partially aligned with the local magnetic field via Purcell's suprathermal spin-up mechanism. Core-mantle, porous and composite particles are investigated in the Rayleigh approximation. In the

ases of composite and porous grains, the effective refractive indices are computed by the approximate T-matrix rule.

The influence of grain chemical composition, elongation and structure is investigated. Differences in polarization between composite and core-mantle models are found. The mixing of grain materials smoothes the individual spectral features of chemical components. Addition of graphite to silicate grains causes the 10  $\mu\text{m}$  feature to shift to shorter wavelengths, while further increase in the fraction of graphite also shifts to 20  $\mu\text{m}$  feature to shorter wavelengths and decreases its strength. Increasing the elongation of the grains reduces the negative polarization of the 3  $\mu\text{m}$  ice feature, shifts both sil-

icate features to longer wavelengths, and increases the strength of the 10  $\mu\text{m}$  and 20  $\mu\text{m}$  peak positions to longer 20  $\mu\text{m}$  band. Increasing the porosity leads to similar effects.

It is found that the grain models presented here are in good agreement with observational data for the BN and AFGL 2591 objects. The absence of polarization excess near 3  $\mu\text{m}$  for AFGL 2591 is attributable to a decrease in elongation of large grains as a result of coagulation. Attention is directed to the real distribution of interstellar dust grains with respect to the elongation parameter. The determination of this distribution function and its evolution during the processes of accretion and coagulation are necessary.

### LIST OF ABSTRACTS

BOUNDARY LAYERS AROUND T TAURI STARS  
P. D'Alessio, J. Cantó, S. Lizano, & N. Calvet 209

ABOUT ONGOING LOW MASS STAR FORMATION IN NGC 6611 E. de Lara, C. Chavarría-K., & M.A. Moreno Corral 209

ROSAT X-RAY SOURCES IN ORION STAR FORMING REGION J.M. Alcalá, J. Krautter, J. Terranegra, J.H.M.M. Schmitt, C. Chavarría-K., & E. Covino 209

DUST IN PRE-MS SYSTEMS: GRAIN GROWTH? T. Mannings 210

RADIO CONTINUUM, AMMONIA AND WATER MASER OBSERVATIONS OF BRIGHT, UNASSOCIATED IRAS POINT SOURCES A.P. Miralles, L.F. Rodríguez, & E. Scalise 210

KINEMATICS OF THE GALACTIC SUPERNOVA REMNANTS RCW 86, MSH 15-56, AND MSH 11-61 P. Ambrocio, M. Rosado, J. Le Coarer, & M. Marcellin 210

THE O<sup>++</sup>/H<sup>+</sup> ABUNDANCE RATIO IN GASEOUS NEBULAE DERIVED FROM RECOMBINATION LINES M. Peimbert, P.J. Storey, & J. Torres-Peimbert 211

INTERSTELLAR MATTER IN THE REGION OF THE OPEN CLUSTER IC 4665 A. Frontó, P. Abraham, & L.G. Balázs 211

THE LOW LUMINOSITY CENTRAL STAR OF THE PN ESO 166-21 M. Peña, M.T. Ruiz, & S. Torres-Peimbert 211

LUMINOSITY FUNCTION OF THE STARS IN THE GALACTIC BULGE

A. Ruelas-Mayorga & P.F. Teague 212

A CODE TO COMPUTE STELLAR MASSES ONTO THE H-R DIAGRAM G. Baume, S. Paoli, R.A. Vázquez, & A. Feinstein 212

RECENT ADVANCES IN THE DEVELOPMENT OF THE UNAM SCANNING FABRY-PEROT INTERFEROMETER (PUMA) FOR THE STUDY OF INTERSTELLAR MEDIUM

A. Bernal, F. Cobos, F. Garfias, L. Gutiérrez, R. Langarica, M. Rosado, C. Tejada, & S. Tinoco 212

EVOLUTION OF SUPERNOVA REMNANTS

A. Santillán, M. Różycka, J. Franco, & G. Tenorio-Tagle 213

HIGH VELOCITY EJECTA FROM ETA CARINAE R.J. Dufour 213

GAS AND DUST OF W49A R. Miyawaki, M. Hayashi, & T. Hasegawa 213

A CRITICAL COMPILATION OF OSCILLATOR STRENGTHS FOR Fe II LINES S. Giridhar & A. Arellano Ferro 214

UVSTAR, A SPECTROGRAPHIC TELESCOPE FOR THE SHUTTLE HITCHHIKER-M BRIDGE R. Stalio, B.R. Sandel, A.L. Broadfoot, & M. Chávez 214

A SPECTROSCOPIC STUDY OF SUBLUMINOUS STARS IN NGC 2264 R. Mújica, C. Chavarría-K., L. Corral, & L. Neri 214