COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4677

Konkoly Observatory
Budapest
2 March 1999

HU ISSN 0374 – 0676

DISCOVERY OF 29-MIN PULSATIONS IN THE CHEMICALLY PECULIAR STAR HD 13038

PETER MARTINEZ[1], B.N. ASHOKA[2], D.W. KURTZ[3], S.K. GUPTA[4], U.S. CHAUBEY[4]

[1] South African Astronomical Observatory, P.O. Box 9, Observatory 7935, South Africa, e-mail: peter@saao.ac.za

[2] ISRO Satellite Applications Centre, Airport Rd, Bangalore 560 034, India, email: ashoka@isac.ernet.in

[3] Dept of Astronomy, University of Cape Town, Rondebosch 7700, South Africa, dkurtz@uctvms.uct.ac.za

[4] Uttar Pradesh State Observatory, Manora Peak - 263 129, Naini Tal, India

The star HD 13038, which is classified as A3 in the Henry Draper catalogue, has Strömgren colours $b-y = 0.102$, $m_1 = 0.213$, $c_1 = 0.866$ and $\beta = 2.860$. The Hβ index is consistent with an early A type, and the metallicity ($\delta m_1 = -0.022$) and luminosity ($\delta c_1 = -0.055$) indices are indicative of strong line blanketing in the Am and Ap stars.

On night JD2451146, HD 13038 was observed photometrically as part of a survey for rapidly oscillating Ap stars in the northern hemisphere being conducted from the Uttar Pradesh State Observatory in Naini Tal. The observations were acquired using the ISRO high-speed photometer attached to the 1-m Sampurnanand telescope of the UPSO. The observations comprise continuous 10-s integrations in Johnson B light. A 30-arcsec aperture was used to minimize the effects of seeing fluctuations and tracking drifts. As we were searching for oscillations in the 6–16 minute range, no comparison stars were observed. The observations were interrupted for occasional measurements of the sky background.

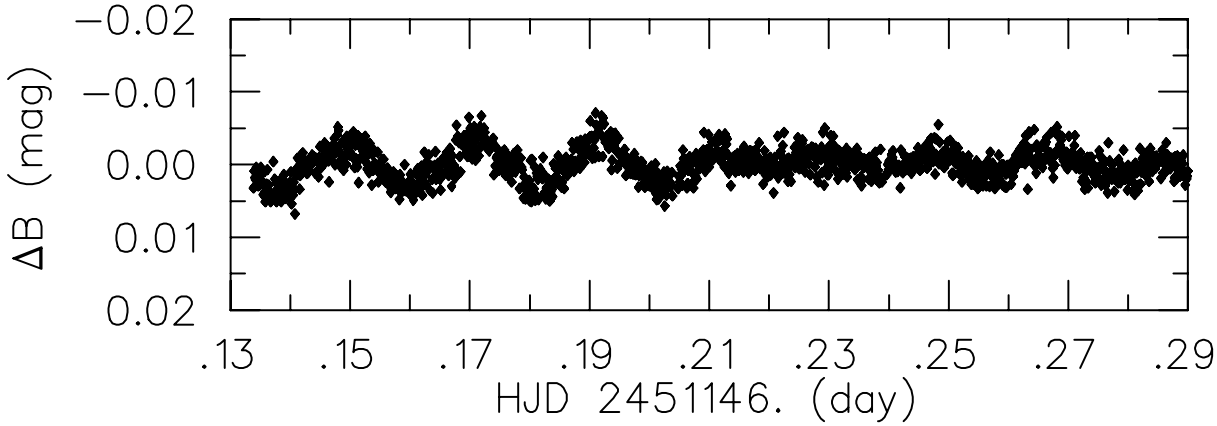

Figure 1. The discovery light curve showing beating.

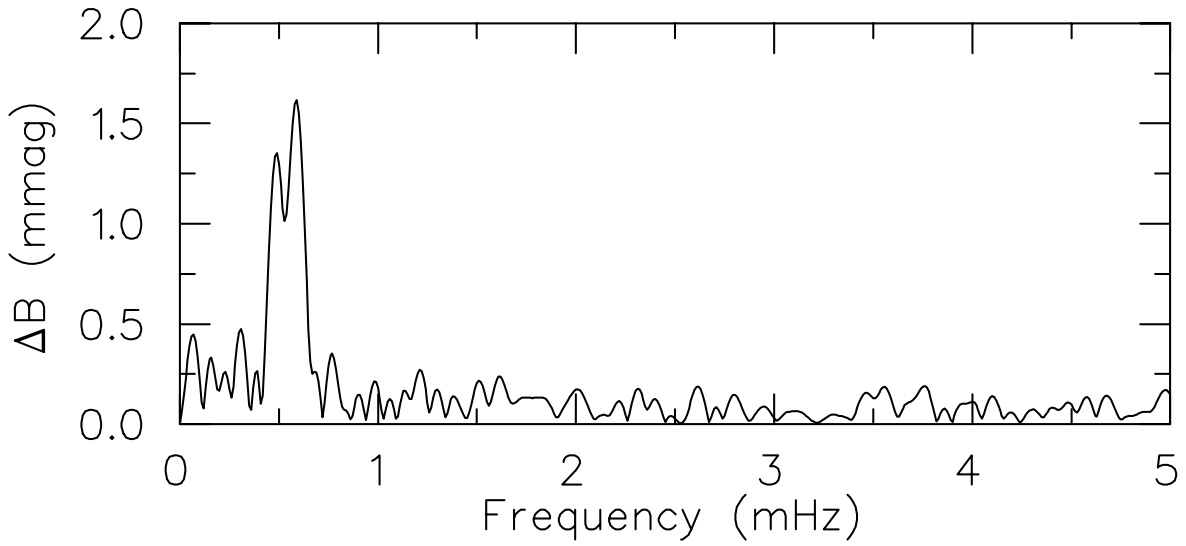

Figure 2. Fourier transform of the discovery light curve.

The data were corrected for coincidence counting ('dead time') losses, sky background and a mean extinction of $\kappa_B = 0\overset{\mathrm{m}}{.}26$/airmass, respectively. Since these were single-channel measurements, some sky transparency variations are to be expected in such data. Figure 1 shows the discovery light curve. Notice the change in amplitude, indicative of beating of two or more frequencies.

Figure 2 shows the Fourier transform of the light curve. The Figure shows only frequencies up to 5 mHz, but we have examined all frequencies up to the Nyquist frequency and find no further periodicities. The sky transparency variations (as evidenced by the noise for $\nu \leq 0.5$ mHz) were negligible in this 3.8-hr light curve. The noise at those low frequencies is comparable to the scintillation noise. Such remarkably stable sky transparency is relatively rare, but this Figure demonstrates the photometric quality attainable at Naini Tal on an excellent night.

The bimodal nature of the dominant peak in the Fourier transform indicates that the oscillations are multiperiodic. The frequencies and amplitudes of the two components of this peak are 0.59 mHz/1.61 mmag and 0.49 mHz/1.33 mmag. This corresponds to a beat period of 2.78 hr. We have confirmed the presence of these oscillations and their multiperiodic character on three subsequent nights.

The nature of HD 13038 is unclear. The pulsation periods (28 and 34 min) are much longer than those of the roAp stars (which span 6–16 min) and rather short for δ Scuti stars ($P \geq 1/2$ hr). Moreover, there are no confirmed Ap stars known to exhibit δ Scuti pulsation, although a few ρ Pup stars (evolved marginal Am stars) do, as does the classical Am star HD 1097. To clarify the nature of HD 13038, spectroscopic observations are being acquired. These will be presented together with a detailed frequency analysis in a future publication.