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**MICRO-FLARING OF dMe STARS : A CONNECTION
BETWEEN X-RAY LUMINOSITIES AND "TIME
SIGNATURES" OF ULTRAVIOLET FLUCTUATIONS ?**

The recent developments of a modified auto-correlation (MAC) technique which utilizes least-square successive differences (Andrews 1988a) have been applied to 1-second U-band monitoring data of the flare star, Gliese 735 (= V1285 Aql). The MAC parameter is examined in the frequency domain to detect significant peaks indicative of quasi-periodicities which have been termed "time signatures". The interpretation of the time signature is that of a characteristic time-scale of fluctuations of dMe flare stars outside large flares. The fractional contribution of micro-flaring to the total energy of the flaring mechanism is difficult to estimate. Attempts have been made in the past to assess their contribution from the form of the cumulative distribution function of the number of flares above a certain threshold. Also, the U-magnitude of a flare star at the beginning of a night's monitoring has been utilized to estimate the "level" of micro-flaring each night (Kunkel 1967). The present work does not yet lead us to a quantitative measure of micro-flaring but an interesting result has emerged which appears to tie-in with our concepts of the flaring mechanism as a grand solar-type scenario. Simultaneous optical spectroscopy and X-ray monitoring of stellar and solar flares shows that a well-defined linear relation exists between the integrated $H\gamma$ and soft X-ray fluxes that extends over four orders of magnitude (Butler, Rodono and Foing 1988). The U-band contains the higher Balmer lines which will contribute a sizable emission component during micro-flares,

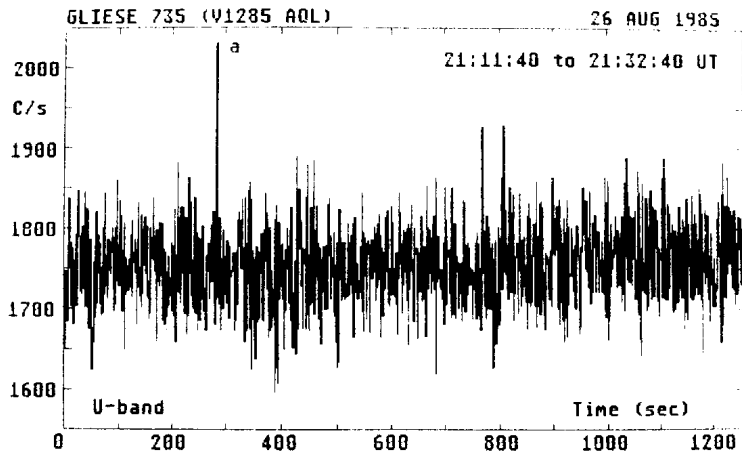


Fig.2. Photometric data for Gliese 735 on 26 August 1985 utilized in the MAC analysis consisting of ultraviolet pulse-counts per second. Letter "a" indicates a spike flare of duration 2 seconds

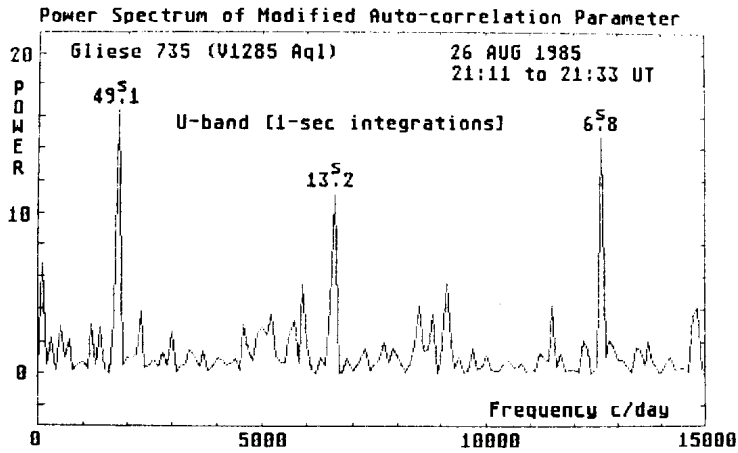


Fig.1. Power spectrum of MAC parameter for Gliese 735 showing three time signatures

and it appears reasonable that any measure of the fluctuations in the U-magnitude of a flare star (outside detected flares) should be related to the "quiescent" X-ray flux of the star.

There is now information on the time signatures of five flare stars obtained using remarkably short segments of U-band monitoring mostly at 1-second time resolution (Gliese 803 being the exception, at 5-second resolution). The results are given in Table 1, together with the logarithm of the X-ray luminosities from Bookbinder (1985) and Pallavicini (1988). An unpublished result recently obtained for G735 suggests that there are at least three distinct time signatures for this star less than 1 minute (Fig.1). The data for G735 is shown in Fig.2 for a monitoring run at 1-second resolution over an interval of 21 minutes. A spike flare occurred at 21:16:23 UT lasting only two seconds (marked "a" in Fig.2). We note that when this spike was removed from the data the MAC analysis showed no discernible change, i.e. the spike did not contribute exceptionally to produce any of the three peaks in Fig.1.

The flare stars in Table 1 have been arranged in order of increasing X-ray luminosity. We note that when the time signatures are assigned, admittedly in a biased manner, to three different columns, TS_1 , TS_2 and TS_3 , that each TS increases with increasing $\log L_X$, with the exception of G799AB. Also, for G863 there is no high time-resolution data for the detection of a possible TS_3 . For G551 there is a weak peak near 11.4 sec (Andrews 1988c). The fact that the optical and X-ray data are not simultaneous and only one data set was examined for each star means that changes in the time signature with stellar activity cycles cannot yet be discussed. It is, however, an important aspect of micro-flaring deserving further investigation. Utilizing such short segments of U-band data, the MAC technique certainly promises to be an interesting line of investigation. Higher time-resolutions with larger instruments, to at least 0.1-second, would be worthwhile to detect the full range of possible time signatures. Furthermore, we are planning high time-resolution spectroscopy to examine this phenomenon in detail.

TABLE 1

Time signatures (secs) and X-ray luminosities of five flare stars

Identification	TS_1	TS_2	TS_3	$\log L_X$	Refs
G644AB (V1054 Oph)	24.7	8.9	5.8	26.8	1,3
G551 (V645 Cen)	31.3	11.4	6.3	27.0	1,4
G735 (V1285 Aql)	49.1	13.2	6.8	28.9	2,5
G799AB (B = AT Mic)		12.8	7.8	29.2	1,6
G803 (AU Mic)	54	25.4		29.9	1,3

Refs: (1) Bookbinder (1985) (2) Pallavicini 1988 (3) Andrews (1988b) (4) Andrews (1988c) (5) Andrews (present work) (6) Andrews (unpublished)

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