Activity in Flare Stars

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The Rise to Peak Light in dMe Flares

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We regret the lack of manuscripts by Dr. KUNKEL. We therefore refer to his papers of the last years, which can be found in Astronomy and Astrophysics Abstracts.

A Report on Flare Stars on the Sproul Astrometric Program

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The long range program of the Sproul Observatory initiated in 1937 by P. VAN DE KAMP has been primarily devoted to a detailed astrometric study of the positions of nearby stars from photographs taken with the 24-inch refractor. By now there are 30 years of observations on most stars with parallaxes greater than $+ 0''.10$ and brighter than the 12th magnitude which are observable at latitude $+40°$. It follows therefore that there are long series of photographic records of many red dwarf stars.

It is well known that M-dwarf stars which are prone to flare are those which normally show emission lines; we may consider all dMe stars suspect of flaring at some time. Table I lists 56 stars in 49 systems on the Sproul program with spectra later than dM1 showing emission lines (GLIESE 1969). Twenty-four are components of double or triple systems, 18 are known flare stars. Two other flare stars, fainter components of binary systems, do not appear in the quiescent state as the exposure time is adjusted to record the brighter component only. Table I supersedes the one appearing in an earlier report on flare stars (LIPPINCOTT 1952). The second column of Table I gives the Gliese number (GLIESE 1969), column 4 gives the time interval over which the observations were made.

The Sproul 24-inch refractor is corrected for visual wave-lengths. The combination of G-type emulsion with a Schott OG515 filter achieves a maximum sensitivity at λ 5610, limited toward the blue by the filter and toward the red by the emulsion sensitivity. Prior to 1967 a Wratten No. 12 filter was used which yields approximately the same results. This spectral wave length region has only one line which has appeared in emission during flare, namely He I at λ 5876. The brightening in the continuum is much stronger in the shorter visual wavelengths, therefore the situation is not ideal for flare detection. The basic exposure time, at present, for an 11th magnitude star is 1 minute. There has been a gradual decrease in exposure times over the years due to the increased sensitivity of the photographic emulsions. Table I column 8 gives the current basic exposure time in minutes. In general program stars brighter than the 10th magnitude are exposed under a rotating sector in order to have their photographic images of the same density, or diameter, as those of the fainter reference stars. There are a few special-interest stars fainter than the 12th magnitude on the program. Usually 16 exposures per star are taken on one night, distributed on two $5'' \times 7''$ pieces of glass. After 4 exposures spaced a millimeter apart the plate is rotated 180° in its own plane and 4 more exposures are made. There is not more than a small fraction of a minute between exposures, and currently under a minute between plates. Prior to 1967 a trip to the dark booth in the dome was necessary to rotate the plate in its holder. This has been eliminated