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PHOTOMETRY OF NQ Gem: A QUIESCENT SYMBIOTIC STAR?

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HD 59643 (NQ Gem) is a bright carbon star classified as C6,2 by Keenan & Morgan (1941). Its variability was not even suspected prior to 1970, when Greene & Wing (1971) much to their surprise found hydrogen emission lines in their spectra and filling-in of both the Ca II K line and the 0–0 CN band. They pointed out similarities with the symbiotic stars CH Cyg and T CrB.

To the best of our knowledge, the only report about photometric variability of NQ Gem has been so far presented by Dzervitis et al. (1979). Their BVR photoelectric data indicate NQ Gem to be a semiregular variable with a peak-to-valley amplitude of ΔB=0$^{\rm m}$.22, ΔV=0$^{\rm m}$.26 and ΔI=0$^{\rm m}$.20. Single epoch observations of NQ Gem by Walker (1979) give V=7.99, $V-R_{\rm C}$=+1.02 and $V-I_{\rm C}$=+1.93 mag. These colors are quite blue compared to normal carbon stars (e.g. Richer 1981). Very blue colors are known also for the well established carbon symbiotic star Draco C-1. In the photometric survey of carbon stars by Noguchi et al. (1981) NQ Gem entries at J=4.05, $J-H$=+0.72, $J-K$=+1.10 and $K-L$=+0.02 mag. They confirm the evidence from the optical of very blue colors for a carbon star and absence of detectable circumstellar dust. As opposed to the poor optical photometric monitoring, a number of IUE (35) and optical spectra of NQ Gem have been obtained in the past. Johnson et al. (1988) found in the IUE spectra the continuum and the bright emission lines to vary in time. This is similar to what is observed in the symbiotic stars EG And (M2 III) and UV Aur (C2,6) that do not reveal much of their interacting binary nature in the optical, while in the IUE spectra the presence and variability of the hot companions stand out clearly.

We have secured in 1995–97 $BVI_{\rm C}$ photographic photometry of NQ Gem with two private 0.25m f/2 Schmidt cameras from San Cristoforo (Trento) in the Italian Pre–Alps. Filter and emulsion combinations, number of plates per year and typical error of a single measurement (σ) are given in Table 1. Plates have been measured with an iris Becker microphotometer. Similar exposures on the Pleiades served to calibrate a comparison sequence around NQ Gem. In Table 1 we list only the yearly mean magnitudes in view of the small (if any) variability shown by the star over the 1995-97 period compared with the typical error of photographic photometry. Further observations at the precision achievable with photoelectric or CCD photometers are necessary in order to detect the presence of the small amplitude variability reported by Dzervitis et al. (1979). It is however clear

Table 1: NQ Gem mean magnitudes for the years 1995, 1996 and 1997. N=number of plates measured per year, σ=error of a single measurement, $\overline{mag}$=yearly average magnitudes.

band	emulsion+filter	1995			1996			1997		
		N	σ	$\overline{mag}$	N	σ	$\overline{mag}$	N	σ	$\overline{mag}$
B	103a–O + GG355	15	0.3	9.5	8	0.3	9.6	14	0.3	9.6
V	Tri X + GG14	21	0.2	7.2	13	0.2	7.2	23	0.2	7.3
I_C	IR High Speed + RG665	30	0.2	5.8	41	0.2	5.9	8	0.3	5.8

from Table 1 that NQ Gem does not show variability in excess of 0.2 mag in any band and there is no year-to-year change in the mean brightness. Therefore on pure photometric grounds NQ Gem could easily escape detection on all-sky surveys.

Symbiotic stars have been discussed as possible SN Ia progenitors. The main objection against such a scenario has been an apparently low number of symbiotics in the Galaxy compared to the observed SN Ia rate. Munari & Renzini (1992) gave arguments for a total population of $\sim 3 \times 10^5$ symbiotic stars in Galaxy. One of their main points is the low discovery probability of symbiotics in the optical. For example, CH Cyg was the spectroscopic standard for the M6 III type until 1963 when it revealed its symbiotic nature entering a still ongoing outburst with all sorts of photometric and spectroscopic changes (e.g. Mikolajewski et al. 1990). EG And and UV Aur are other examples of symbiotic stars looking as fairly normal field cool giants in the optical. NQ Gem appears as another example of easy-to-miss symbiotic stars. During this long lasting quiescence, its hot component is accreting mass from the carbon giant. Greene & Wing (1971) suggested that sooner or later HD 59643 should erupt. We recommend monitoring of this apparently quiescent symbiotic star, for soon it might show major activity.

References:

Dzervitis U., Paupers O. and Spulgis G. 1979, *Issledovanie Solnca i krasnih zvezd*, **9**, 23
Greene A.E. and Wing R.F. 1971, *ApJ*, **163**, 309
Johnson H.R., Eaton J.A., Querci F.R., Querci M. and Baumert J.H. 1988, *A&A*, **204**, 149
Keenan D.C. and Morgan W.W. 1941, *ApJ*, **94**, 501
Mikolajewski M., Mikolajewska J. and Khudyakova T.N. 1990, *A&A*, **235**, 219
Munari U. and Renzini A. 1992, *ApJ*, **397**, L87
Noguchi K., Kawara K., Kobayashi Y., Okuda H., Sato S. and Oishi M. 1981, *PASJ*, **33**, 373
Richer H.R. 1981, *ApJ*, **243**, 744
Walker A.R. 1979, *SAAO Circ.*, **1**, 112