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A SEARCH FOR VARIABLE POLARIZATION IN V3885 Sgr

In 1983 a number of polarimetric runs of the nova-like system V3885 Sgr with the variable brightness B = 9.6 - 10.3 (Ritter, 1987) were obtained with the old ESO polarimeter at the Bochum 62 cm telescope at La Silla. The aim was to search for any time dependent variations of the linear, as well as the circular polarization in order to get further information about the binary character of the system.

The polarimeter was equipped with two blue sensitive EMI 9789 photomultipliers. From the count numbers of V3885 Sgr measured without filters on the first night the polarimetric error of the system caused only by photon statistics was of the order of $\varepsilon(p) = 0.8\%$ at the Bochum telescope assuming an integration time of one sec for each of the 16 steps of the rotating superachromatic half - or quarter wave plate in the old ESO two-channel polarimeter (Serkowski, 1974). Since it was known from measurements of other cataclysmic variables (e.g. Haefner and Metz, 1982, Metz, 1982) that the degree of the intrinsic polarization of those systems was expected not to exceed 0.1% and considering further the brightness of V3885 Sgr, no colour filters were used. In view of the necessary time resolution, an integration time of 10 sec was selected for each of the 16 steps referred for one rotation of the phase plate in the polarimeter. With a dead time of two sec for each step one single polarization measurement lasted about 3 min. From the photon statistics it was evident that only some hundreds of single measurements could detect the expected traces of correlation between intrinsic polarization and phase dependent variations of spectra and photometric behaviour. Because of the extremely bad weather conditions and some errors in the electronics of the polarimeter a special computer program was written to find the erroneous measurements and to determine the dummy periods caused by several gaps in the observations. As a general rule, only circular polarization measurements were performed after the moon had risen. After eliminating all erroneous measurements altogether 465 linear and 404 circular polarizations could be regarded as reliable observations.

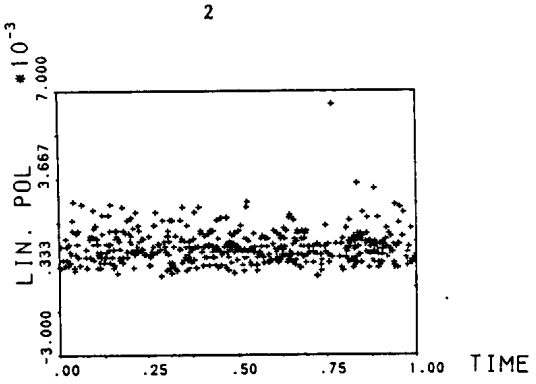

Figure 1. The measured linear polarization degree P folded with the spectroscopic period P_s

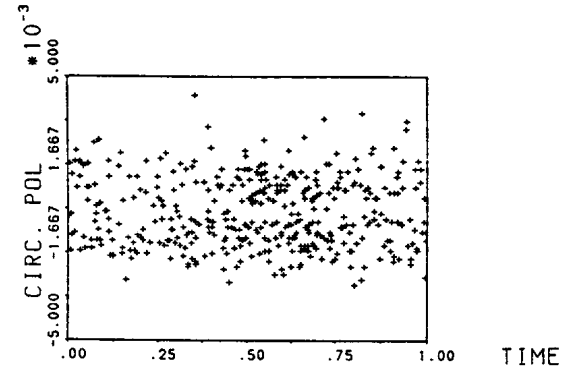

Figure 2. The measured circular polarization P_v folded with the spectroscopic period P_s

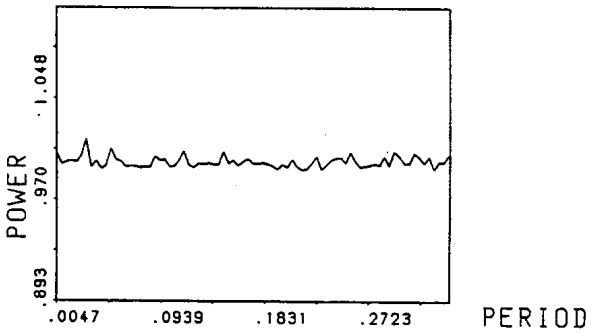

Figure 3. Periodogram of the linear polarization degree P

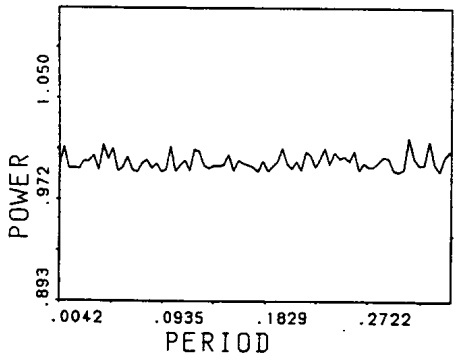

Figure 4. Periodogram of the circular polarization P_v

In Figure 1 the linear polarization degree $P = (P_x^2+P_y^2)^{0.5}$ where $P_x = Q/I$, $P_y = U/I$ are the normalized linear Stokes parameters, folded with the spectroscopic period $P_s = 0^d.2163$ is presented. P_s was found in spectra taken simultaneously with polarimetric measurements (Haefner and Metz, 1990).

Averaging all values of P_x and P_y in the equatorial coordinate system:

$P_x = 0.0002$ with $\varepsilon(P_x) = 0.0004$ (the mean error of the mean)
$P_y = 0.0002$ with $\varepsilon(P_y) = 0.0004$ (the mean error of the mean)
the mean linear polarization degree is: $P = 0.0003$
the mean position angle in degree is: $\theta_E = 21^o$
with the mean errors of the mean: $\varepsilon(P) = 0.0001$
$\varepsilon(\theta_E) = 10^o$

Figure 2 shows the circular polarization P_v, where $P_v = V/I$ is the normalized circular Stokes parameter, folded again with the spectroscopic period P_s.

Averaging all measurements of the circular polarization gives the mean circular polarization $P_v(\text{mean}) = (V/I)\ (\text{mean}) = -0.0001$
with the mean error of the mean $\varepsilon(P_v) = 0.0001$.

Considering the results of the extensive polarization measurements two points should be emphasized:
1) Since the distance of V3885 Sgr itself and that of several measured comparison stars is not very well known (Bond, 1978), it is, with respect to resulting errors, not useful to subtract a necessarily uncertain

interstellar component from the small linear and circular polarization determined here in order to get the intrinsic component of V3885 Sgr. 2) Since the standard deviations of the measured linear and circular polarization are surprisingly in accordance with the error estimated from the photon statistics, it was clear that no larger variation of the polarization with any period could be expected. This can also be derived from Figures 3 and 4 where periodogram analyses of P and P_v are presented. (Instead of P, the polarizations P_x, P_y were also tested, which gave the same result as the derived quantity P!)

Additionally, phase diagrams were constructed for various assumed values of the period P in the range of $0^d.00417$ to $0^d.3417$, rigorously averaging over intervals of P/10, in order to look for any periodic variation of the polarization. However, no periodic variation of the polarization could be found thus demonstrating that polarization measurements cannot help in understanding the character of V3885 Sgr.

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