RevMexAA (Serie de Conferencias), **20**, 247–247 (2004)

FLICKERING MAPPING OF THE CATACLYSMIC VARIABLES

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We report results of simulation to evaluate the ability of the eclipse mapping method to reproduce the spatial distribution of flickering in cataclysmic variables stars.

1. INTRODUCTION

Flickering is a fast intrinsic brightness scintilation occurring on time scales from seconds to minutes with amplitudes of 0.01 - 1 mag. Flickering is observed in all sources believed to be powered by accretion is considered a fundamental signature of accretion. Nevertheless, it is one of the least undestood aspects of the accretion process.

Cataclysmic variables are possibly the best sites to investigate the flickering phenomenon because in these systems the masses of the component stars and geometry are well determined and the existence of eclipses yields a unique opportunity to isolate the emission of different regions in the binary. Here we report on a study aiming at investigating the ability of the eclipse mapping method to reproduce the spatial distribution of flickering in cataclysmic variables stars.

2. SIMULATIONS AND RESULTS

In order to generate the artificial orbital curves and therefore to obtain the flickering curves, four possible sources of flickering have been assumed: (I) inner parts of the disc; (II) the shock region between the matter beam that come from secundary and the disc (bright spot); (III) the inner parts of the disc + bright spot; and (IV) a broadened source on the disc. Concerning geometric configuration, the following values have been used: $i = 78$ and $q = 0.3$. Those values correspond to the geometry of the UU Aqr, according to ones obtained Baptista, Steiner & Cieslinski (1994).

To generate the curves of flickering, exist two methods: 'ensemble' (Horne & Stiening 1985; Bennie, Hilditch & Horne 1996; Bruch 2000) and 'single' (Bruch 1996). The two techniques are complementary. The 'ensemble' method samples flickering at all frequencies. On the other hand, the 'single' method produces curves which sample only the high-frequency flickering. Thus, the combination of both methods opens the possibility to separate high- and low-frequency components of the flickering.

With the codes that generate the light curves, we produce sets of curves of light with the number of curves ranging from 5 up to 50 curves. We used the methods cited above to obtain the curves of flickering to each sets of the light curves. The results of this simulation show that, from a set with Nc=15 light curves we get an orbital amplitude curve of flickering with a satisfactory value of S/N for an analysis that uses techniques of mapping for eclipses. In other words, Nc=15 can be adopted as a lower limit for the number of light curves to analyse the flickering light curve.

With the number of curves of light of the fixed data set (Nc=15), we have generated other sets of light curves, now varying the value of the relation of S/N between 20 and 100, and we have calculated new flickering curves. For S/N<20, the flickering curve obtained from a set of light curves presents a symmetrical eclipse, although with low quality. For values of relation S/N>30 there is no considerable improvement in the curve of flickering. The increase of the amount of light curves improves the definition of the curve of flickering as a whole, that is, the entire curve of flickering shows a better quality, whereas an increase in the value of the relation S/N in the light curves presents a weaker improvement. Therefore, the quality of the resulting flickering curve is more sensitive to the number of curves of light than to the relation S/N for each individual curve of the sample. Our tests show that light curves with S/N=30 are enough to produce good curves of flickering.

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