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The periodic microquasar LS I +61°303 in the radio and gamma-ray bands

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Abstract. We here interprete multiband observations of LS I +61°303 in the scenario of a two peak accretion/ejection model.

Key words. Stars: individual: LS I +61°303 – X-rays: binaries

1. Radio and gamma-ray data

The binary system LS I +61°303 has an orbital period of 26.5 days and a quite eccentric orbit; it is composed of a compact object and a Be star with equatorial mass loss (Hutchings & Crampton 1981). Radio outbursts occur with the orbital periodicity around apoastron and the morphology of the radio emission is jet-like (Fig. 1). The jet is relativistic with $\beta \simeq 0.6$ and extends to ca. 200 AU at both sides of a central core (see Massi et al. 2004a). This morphology, typical of a microquasar, is the observational evidence of the occurrence of accretion/ejection processes in this system. EGRET data folded with the orbital/radio period show (Fig. 2) one peak (Φ= 0.2, 1.2) and traces of a second one (Φ= 0.3) at periastron passage (Φ= 0.2, 1.2) along with another displaced peak ($\Phi \sim 0.5$) (Massi et al. 2004b).

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2. The two peak accretion model

Taylor et al. (1992) and Martí & Paredes (1995) have modelled the properties of this system in terms of an accretion rate which develops two peaks because of the high orbital eccentricity: One peak occurs at the periastron passage, where the density of the wind of the Be star is the highest, while the second peak occurs at that orbital phase (changing with variations in the mass loss) when the drop in the velocity of the accretor compen-

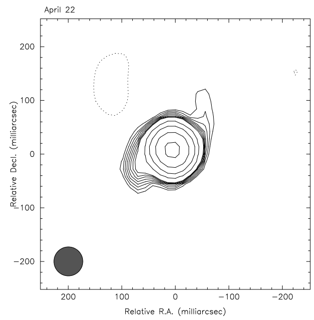

Fig. 1. MERLIN image at 5 GHz (Massi et al. 2004a).

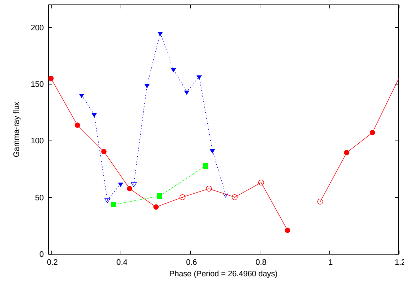

Fig. 2. EGRET data vs. orbital phase (Φ=0.2, 1.2 is periastron passage) (Massi et al. 2004b).

sates the decrease in density. During the first ejection at the periastron, because of the proximity of the Be star, inverse Compton (IC) scattering of UV stellar photons by the relativistic electrons of the jet is expected (Bosh-Ramon & Paredes 2004) and confirmed by the presence of high energy emission (Fig. 2). Moreover, the IC losses must be so severe that no electrons survive, indeed, radio outbursts were never observed at the periastron passage in more than 20 years of radio flux measurements (Gregory 2002).

At the second accretion peak the compact object is enough far away from the Be star, so that IC losses are smaller and electrons can propagate out of the orbital plane. At that point an expanding double radio source should be observed. That in fact has been observed (Fig. 1) at an orbital phase of 0.7 (apoastron). Interesting in this respect is the gamma-ray peak at $\phi \simeq 0.5$ that could originate from a second ejection which occurred still enough close to the Be star.

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