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NEW RESULTS ON THE MICROQUASAR LS 5039

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LS 5039 is a new microquasar system that may also be associated with the EGRET gamma-ray source 3EG J1824−1514. This microquasar has been observed in several campaigns at different wavelengths. Here, we present an overview of results obtained by us using different telescopes at the Canary Islands and Calar Alto as well as the interferometers MERLIN and the EVN.

Microquasars are radio emitting X-ray binaries with relativistic radio jets. LS 5039 is the most recent addition to the microquasar census in the Galaxy. The source was classified as a high mass X-ray binary system, with an O7V((f)) luminous companion at an estimated distance of 3 kpc. The nonthermal synchrotron radio emission was later discovered using the Very Large Array (VLA). PCA RXTE observations show a power-law spectrum plus a strong Gaussian iron line centered at 6.6 keV. Radio interferometric observations with the Very Long Baseline Array (VLBA) by Paredes et al. (2000) resolved the source into milliarcsecond bipolar radio jets, i.e., the main fingerprint of its microquasar nature. On the other hand, a possible association between the unidentified EGRET high energy γ-ray source 3EG J1824−1514 and LS 5039 seems to exist (Paredes et al. 2000). Recently, from radial velocity studies, McSwain et al. (2001) have determined the orbital parameters of the system: $e = 0.41$, $P = 4.117$ d and the mass function $f(m) = 0.00103\ M_{\odot}$.

We have observed LS 5039 with the European VLBI Network (EVN) on 2000 March 1. The resulting map (see Fig.1) shows a bipolar jet extending up to 50 mas, and with the same position angle as found in Paredes et al. (2000). MERLIN observations (not shown here) at the same epoch also resolve the source, and show that the jets extend up to 200 mas. These results seem to confirm the persistent nature of the jets in LS 5039. At optical wavelengths, we have undertaken several photometrical campaigns with telescopes at the Canary Islands and at Calar Alto. The data obtained show variations of few hundreths of magnitude within a night, but do not display any modulation at longer temporal scales. We have applied different period determination methods to our data, but no positive result was found. Moreover, when the data is folded using a period of 4.117 days, no modulation is present either. The fact that optical photometry does not show an ellipsoidal modulation indicates that either the optical companion underfills its Roche lobe (and hence $P_{\rm orb} \gtrsim 2$ days) or the orbital inclination is very low. The latter case is still consistent with the presence of a black hole in the binary.

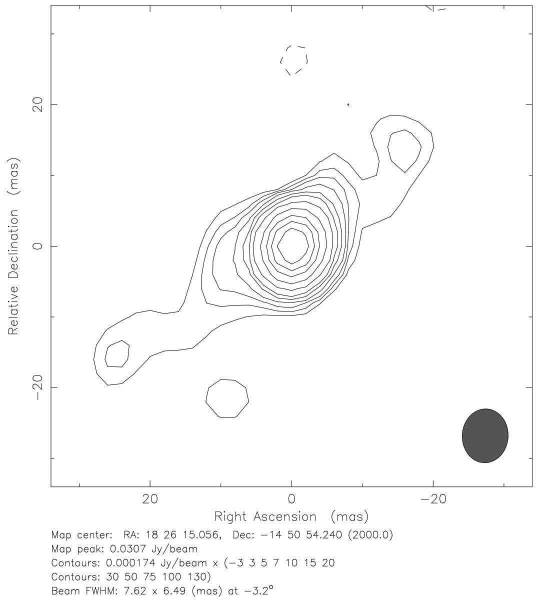

Fig. 1. EVN image of LS 5039.

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