VLBI imaging of a flare in the Crab Nebula: More than just a spot

A.P. Lobanov, D. Horns, T.W.B. Muxlow

(Submitted on 1 Jul 2011)

We report on very long baseline interferometry (VLBI) observations of the radio emission from the inner region of the Crab Nebula, made at 1.6 GHz and 5 GHz after a recent high-energy flare in this object. The 5 GHz data have provided only upper limits of 0.4 milli-Jansky (mJy) on the flux density of the pulsar and 0.4 mJy/beam on the brightness of the putative flaring region. The 1.6 GHz data have enabled imaging the inner regions of the nebula on scales of up to ~40". The emission from the inner "wisps" is detected for the first time with VLBI observations. A likely radio counterpart (designated "C1") of the putative flaring region observed with Chandra and HST is detected in the radio image, with an estimated flux density of 0.5 ± 0.3\,mJy and a size of 0.2-0.6". Another compact feature ("C2") is also detected in the VLBI image closer to the pulsar, with an estimated flux density of 0.4 +- 0.2 mJy and a size smaller than 0{\farcs}2. Combined with the broad-band SED of the flare, the radio properties of C1 yield a lower limit of ~0.5 mG for the magnetic field and a total minimum energy of 1.2*10^41 ergs vested in the flare (corresponding to using about 0.2% of the pulsar spin-down power). The 1.6 GHz observations provide upper limits for the brightness (0.2 mJy/beam) and total flux density (0.4 mJy) of the optical Knot 1 located at 0.6" from the pulsar. The absolute position of the Crab pulsar is determined, and an estimate of the pulsar proper motion is obtained.

Comments: Astronomy & Astrophysics; accepted; 10 pages, 8 figures
Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**
Cite as: **arXiv:1107.0182 [astro-ph.HE]**
(or **arXiv:1107.0182v1 [astro-ph.HE]** for this version)

Submission history

From: Andrei Lobanov [view email]
[v1] Fri, 1 Jul 2011 10:18:42 GMT (3166kb)

Which authors of this paper are endorsers?