The inverse-Compton ghost HDF 130 and the giant radio galaxy 6C 0905+3955: matching an analytic model for double radio source evolution

Philip Mocz, A.C. Fabian, Katherine M. Blundell, P.T. Goodall, S.C. Chapman, D.J. Saikia

(Submitted on 5 Jul 2011)

We present new GMRT observations of HDF 130, an inverse-Compton (IC) ghost of a giant radio source that is no longer being powered by jets. We compare the properties of HDF 130 with the new and important constraint of the upper limit of the radio flux density at 240 MHz to an analytic model. We learn what values of physical parameters in the model for the dynamics and evolution of the radio luminosity and X-ray luminosity (due to IC scattering of the cosmic microwave background (CMB)) of a Fanaroff-Riley II (FR II) source are able to describe a source with features (lobe length, axial ratio, X-ray luminosity, photon index and upper limit of radio luminosity) similar to the observations. HDF 130 is found to agree with the interpretation that it is an IC ghost of a powerful double-lobed radio source, and we are observing it at least a few Myr after jet activity (which lasted 5--100 Myr) has ceased. The minimum Lorentz factor of injected particles into the lobes from the hotspot is preferred to be $\gamma\sim10^3$ for the model to describe the observed quantities well, assuming that the magnetic energy density, electron energy density, and lobe pressure at time of injection into the lobe are linked by constant factors according to a minimum energy argument, so that the minimum Lorentz factor is constrained by the lobe pressure. We also apply the model to match the features of 6C 0905+3955, a classical double FR II galaxy thought to have a low-energy cutoff of $\gamma\sim10^4$ in the hotspot due to a lack of hotspot inverse-Compton X-ray emission. The models suggest that the low-energy cutoff in the hotspots of 6C 0905+3955 is $\gamma\gtrsim 10^3$, just slightly above the particles required for X-ray emission.

Comments: 9 pages, 3 figures
Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**
Cite as: **arXiv:1107.0824 [astro-ph.CO]**

(or **arXiv:1107.0824v1 [astro-ph.CO]** for this version)

Submission history

From: Philip Mocz [view email]

[v1] Tue, 5 Jul 2011 09:16:00 GMT (239kb)

Which authors of this paper are endorsers?