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XMMU J144845+085357, a new X-ray "Compton Ghost"

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Abstract: We present the discovery of an extended XMM Newton source, which we regard as an example of an „inverse-Compton ghost". Deep optical imaging in the course of the XDCP cluster survey failed to detect a cluster of galaxies at the X-ray position. However, we find a faint radio source at 1.4 Ghz, morphologically similar to the X-ray source, but too faint to explain the X-ray source as inverse-Compton emission from the lobe of an active radio galaxy. We therefore conclude that we see remnant inverse-Compton X-rays from jets that have bee switched off. Since the energetic electrons needed for synchrotron radio emission ($\gamma > 10^4$) cool faster than the electrons relevant for inverse-Compton scattering of the CMB ($\gamma \sim 1000$), the extended X-ray source lasts longer than the GHz radio source.

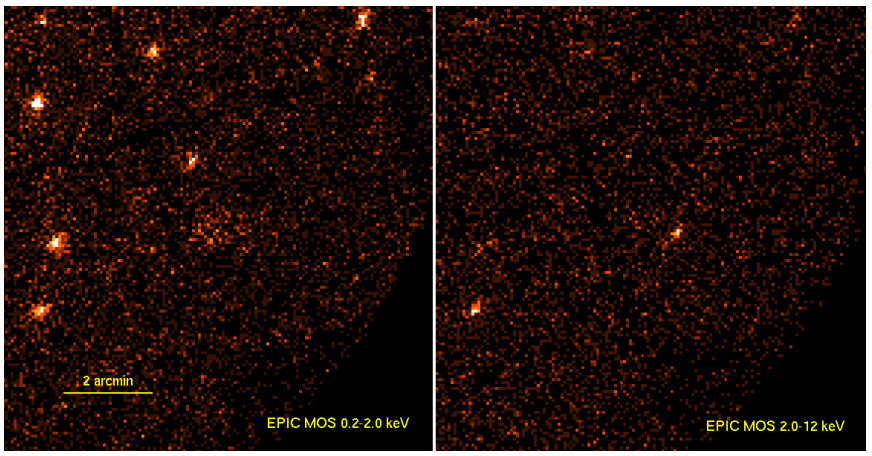

Fig 1: EPIC MOS soft (left) and hard (right) images of the XMMU J144845. The extended source is visible in the softer bands, the hard image reveals an obscured point source. The X-ray spectrum of the extended source is best fit by a power law with α=-0.47.

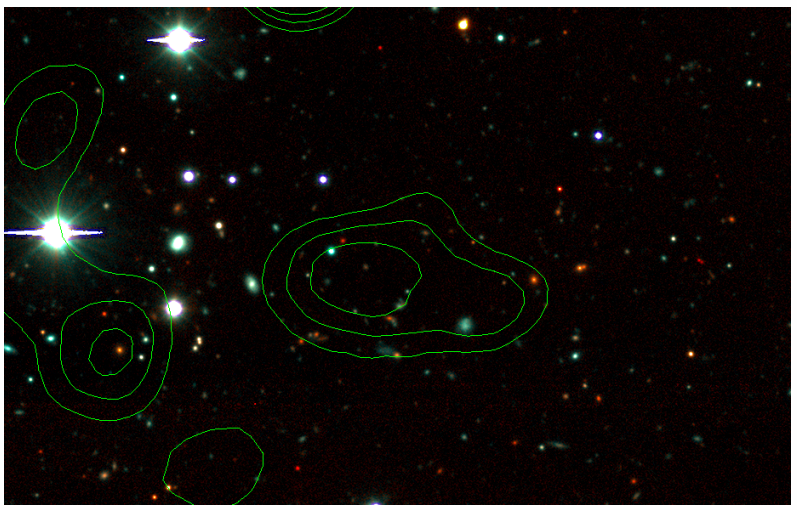

Fig 2: VLT *Rz* colour image with X-ray contours of the extended source. No obvious cluster of galaxies is detected.

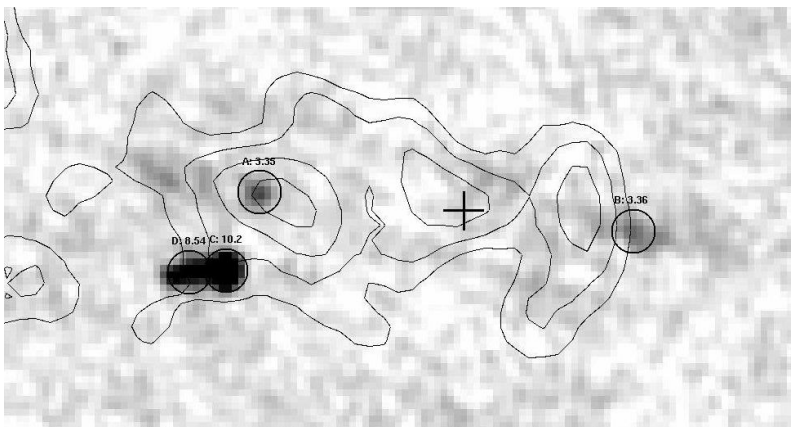

Fig 3: VLA FIRST 1.4 GhZ map with X-ray contours. The cross marks the position of the hard X-ray point source. The extended X-ray source coincides with a faint (3.35 mJy) radio source. The SED slope between radio and X-ray is α_{rx}=0.68, too hard for a normal radio jet. The brighter radio source further south is probably unrelated.

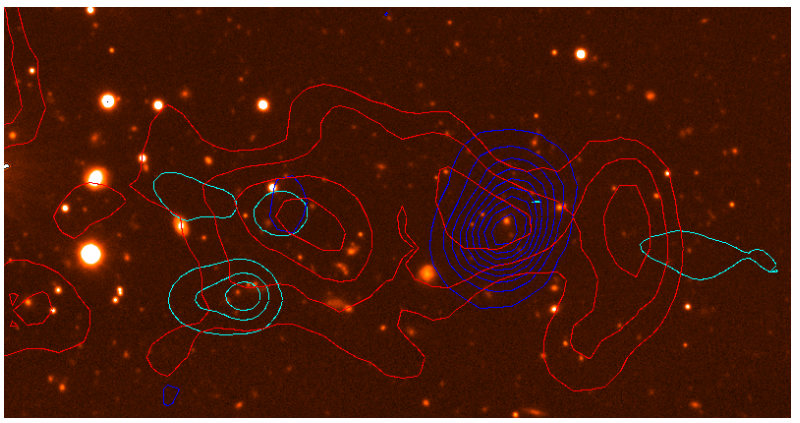

Fig 4: VLT *R* image with X-ray contours (red: 0.2-2 keV, blue: 2-12 keV) and radio contours (1.4 Ghz VLA FIRST). The hard X-ray source has a likely counterpart with a photometric redshift z=0.71. Its X-ray spectrum suggest an AGN obscured by $n_H=1.3 \cdot 10^{23}$ cm^{-2}. At this redshift the luminosity of the extended X-ray source would be $8 \cdot 10^{43}$ erg/sec.

Conclusions: Most likely origin of the extended X-ray source XMMU J144845+085357 is inverse-Compton scattering of CMB photons in a nearly extinct radio jet, a „Compton-Ghost" (see Fabian et al. 2009, MNRAS 395L, 67). Radio jets have been predicted to outnumber galaxy clusters as extended X-ray sources at high redshifts (Celotti & Fabian 2004, MNRAS 353, 528). A number of extended XMM sources related to radio sources have been reported by Finoguenov et al. 2009, MNRAS, 403, 2063). It is likely that a large number of these sources will be detected in the eROSITA surveys.