The SED of 3C 186

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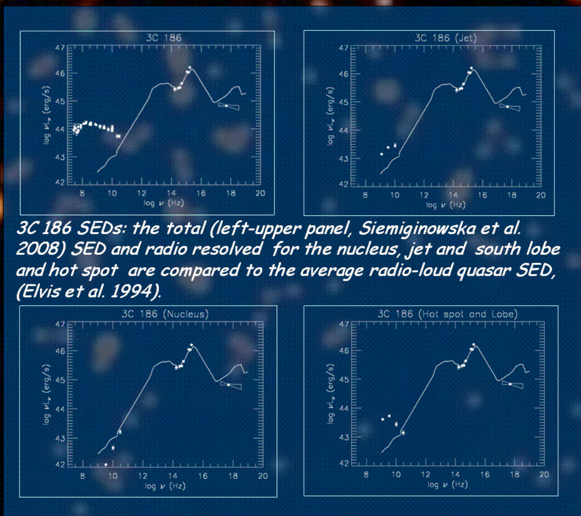
Introduction: studies on young radio sources have been strongly improved with the advent of Chandra X-ray observatory, thanks to its high spatial resolution. However in many cases the extreme compactness doesn't allow to disentangle the contributions of the different components of the source (core, jets and lobes) to the total X-ray emission. In this case, it is necessary to adopt a multiwavelength approach, exploiting the high resolved radio data, in order to model and estimate the X-ray emission from the extended components.

The target: 3C 186 is a Compact Steep Spectrum radio loud quasar at redshift z~1.063. A previous Chandra observation led to the discovery of an X-ray cluster associated to the quasar (Siemiginowska et al. 2005). The study of the interactions of the quasar with the cluster medium allowed to exclude that the source is frustrated in its evolution by the high density of the medium, supporting the idea that 3C 186 is a young (10^5 yrs, Murgia et al. 1999) expanding quasar.
On the left (background), the smoothed Chandra ACIS-S image is shown in the background: as it possible to see, the quasar structure, (the core and the extended components, a jet and the two lobes), of 2 arcsec size is not resolved in the X-ray band.

From the radio to the X-ray: the broadband SED

1. 3C 186 SED (Siemiginowska et al. 2008) vs average radio loud quasar SED (Elvis et al.1994)- main features:
   - strong radio source;
   - X-ray luminosity weaker than the average;
   - optical to X-ray index (α_{ox}=1.74) higher than the averaged value for RL QSO (Bechtold et al.1994, Belsole et al. 2006).

2. Disentangling the radio emission:
   using highly resolved data (Spencer et al. 1991), it is possible determine the radio emission of the different components, core and extended (jet, lobe and hot spot)



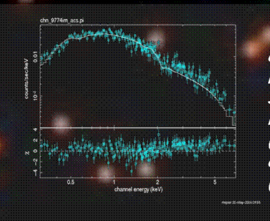
3C 186 SEDs: the total (left-upper panel, Siemiginowska et al. 2008) SED and radio resolved for the nucleus, jet and south lobe and hot spot are compared to the average radio-loud quasar SED, (Elvis et al. 1994).

3. Radio informations can be used to estimate the contributions of the extended components to the total spatially unresolved X-ray emission:
   - possible X-ray radiative mechanisms:
     - -synchrotron
     - -Inverse Compton (IC) on different photons fields (see Celotti et al. 2001, Stawarz et al. 2008): 1.external (UV from the disk, IR from the dusty torus, CMB photons), 2. synch. photons.
   - Using radio, estimates on electron densities and magnetic fields (equipartition assumption).

Preliminary results: a first estimate allows to exclude the importance of X-ray emission due to IC on CMB photons from the lobes ($F_{IC/CMB}/F_{tot}$~10^{-4}), however Stawarz et al. (2008) demonstrated that, in the case of GPS sources, X-ray lobe emission can play an important role when alternative photon fields are considered.

Looking for the expansion signatures: X-thermal emission could be produced by the intergalactic medium heated up by the expanding young radio source (Heinz et al. 1998). A new Chandra observation of 200ksec was used to investigate the presence of this feature:

X-ray Spectral Analysis: the quasar spectrum was accumulated on the central circular region (radius r=1.75") and modeled with an absorbed power law. The presence of a thermal contribution was also investigated (RAYMOND model). The main results are shown here:



3C 186 quasar 0.3-7 keV spectrum: best fit (upper panel) and residuals (lower panel)

<u>Power law:</u>
NH~gal.value, Γ=2.02±0.06
normΓ=(3.2±0.2)*10^{-4}phot $cm^{-2}s^{-1}$
$Flux_{0.5-2}$=1.6*10^{-13}erg $cm^{-2}s^{-1}$
$Flux_{2-10}$=1.8*10^{-13}erg $cm^{-2}s^{-1}$
<u>Power law +thermal emission:</u>
KT=1.44 keV
normKT=3.0*10-5erg $cm^{-2}s^{-1}$

→ less than 10% of the $F_{0.5-2}$ could be due to thermal emission