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Title: X-ray Properties and the Environment of Compact Radio Sources.

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Abstract

Compact extragalactic radio sources provide important insights into the initial stages of radio source evolution and probe states of a black hole activity at the time of the formation of the relativistic outflow. Such outflows propagate out to hundreds kpc distances from the origin and impact environment on many scales, and thus influence evolution of structures in the universe. These compact sources show radio features typically observed in large-scale radio galaxies (jets, lobes, hot spots), but contained within the central 1 kpc region of the host galaxy. Compact Symmetric Objects (CSOs, a subclass of GigaHertz Peaked spectrum radio sources) are symmetric and not affected by beaming. Their linear radio size can be translated into a source age if one measures the expansion velocity of the radio structures. Such ages has been measured for a small sample of CSOs. Using the Chandra X-ray Observatory and XMM-Newton we observed a pilot samples of 16 CSOs in X-rays (6 for the first time). Our results show heterogeneous nature of the CSOs X-ray emission indicating a range of AGN luminosities and a complex environment. In particular, we identified four Compton Thick sources with a dense medium (equivalent column $> 1e24 \text{ cm}^{-2}$) capable of disturbing/slowing down the jet and confining the jet to a small region. Thus for the first time we gain the observational evidence in X-ray domain in favor of the hypothesis that in a sub-population of CSOs the radio jets may be confined by the dense X-ray obscuring medium. As a consequence, the kinematic ages of these CSOs may be underestimated.. We discuss the implications of our results on the emission models of CSOs, the earliest stages of the radio source evolution, jet interactions with the ISM, diversity of the environments in which the jets expand, and jet-galaxy co-evolution. Partial support for this work was provided by the NASA grants GO1-12145X, GO4-15099X, NNX10AO60G, NNX17AC23G and XMM AO15 project 78461. This work supported in part by NASA under contract NAS 8-03060 to the Smithsonian Astrophysical Observatory for operation of the Chandra X-ray Center.

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