Charting the obscured AGN population with deep XMM-Newton observations

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Abstract

Obscured AGN outnumber their unobscured counterparts by a factor of four in the local Universe. The situation elsewhere in the luminosity-redshift plane is less well understood, but is key to reconstructing the Universe's accretion history. The best way to constrain AGN absorption properties over a wide range of luminosity and redshift is by examining the extragalactic X-ray population.

In the very deep XMM-Newton observations of the CDF-S field, there are > 300 X-ray detections, 84% of which have redshift estimates, and nearly all of which are AGN. We determine the absorbing column densities and intrinsic luminosities of these AGN using a Monte-Carlo method, which exploits the wide bandpass (0.2–10 keV), and high thoughput of XMM-Newton. A detailed simulation scheme is then used to compare the X-ray properties of the sources with the predictions of a number of theoretical AGN population models. We find that the observed AGN absorption distribution exhibits no strong dependence on either luminosity or redshift. The best matching population model contains AGN having a wide range of absorbing columns, with the heavily absorbed AGN outnumbering the unabsorbed objects by 3:1. In particular, our results are consistent with there being a large population of luminous but heavily absorbed AGN at high redshift.

In order to mitigate the possible effects of cosmic variance, we also examine a much larger sample of $\sim$1800 AGN, detected in six deep XMM-Newton fields. We compare the X-ray colour distribution of these sources to the predictions of several AGN population models. This comparison, which is sensitive primarily to the AGN absorption distribution, reinforces our earlier findings. We discuss the implications for AGN torus models, and contrast our results to some recent Chandra surveys which find a much smaller population of luminous absorbed AGN.