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The SIX survey: evolution and properties of AGN in the local universe

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Abstract. Current most sensitive surveys at soft X-ray (∼0.5–10 keV) energies by Chandra and XMM-Newton preferably sample AGN at high-redshift (z ¿ 0.5). At low-redshift (z ¡ 0.5), where AGN are supposed to be in their evolution end-stage, these sources are very sparsely sampled. The low-redshift universe is best fathomed at hard X–ray energies (¿ 15 keV) by the INTEGRAL and the Swift missions with their coded-mask telescopes IBIS/ISGRI and BAT respectively. These instruments have two major advantages: 1) they have a huge field of view, hence allowing to sample a large number of AGN at low-redshift; 2) they operate at energies above 15 keV, hence allowing detecting photons with enough power to efficiently pierce even through the Compton-thick torus of AGN. Estimates based on observations with PDS on board the BeppoSAX satellite predict that Compton-thick AGN should dominate over unabsorbed AGN in the local universe playing an important role in reproducing the shape and intensity of the cosmic X-ray background (CXB). However coded-mask detectors suffer from heavy systematic effects preventing them from reaching their theoretical limiting sensitivity. We overcome this limit with a new and alternative approach, which has been designed ad hoc to improve the sensitivity of hard X–ray surveys by using IBIS/ISGRI and BAT. Both telescopes are so close in design that their observations can be combined to obtain a more sensitive survey. The observations are combined with resampling, merging, and cross-calibration techniques. We are able to sample limiting fluxes of the order of ∼3.3 times 10^{-12} erg cm^{-2} s^{-1} in the 18–55 keV energy range. This is called the SIX survey, that stands for Swift-INTEGRAL X-ray survey. The SIX survey extends over a wide sky area of 6200 deg^2 and it is used to obtain a persistent sample of faint AGN. The source number density (log N - log S) is a factor of 3 better than current parent surveys of BAT and IBIS/ISGRI alone. I will present a study of the evolution of AGN in the local universe discussing the X-ray luminosity function. The properties of the AGN circum-nuclear environment will be discussed checking the consistency with the AGN unification scheme. Also I will compare the results from the SIX survey to the results predicted for the NuSTAR survey. Finally preliminary results of the all-sky SIX survey are presented.