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# Probing large-scale structure with large samples of X-ray selected AGN: I. Baryonic acoustic oscillations

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## Abstract

© ESO, 2014. We investigate the potential of large X-ray-selected AGN samples for detecting baryonic acoustic oscillations (BAO). Though AGN selection in X-ray band is very clean and efficient, it does not provide redshift information, and thus needs to be complemented with an optical follow-up. The main focus of this study is (i) to find the requirements needed for the quality of the optical follow-up and (ii) to formulate the optimal strategy of the X-ray survey, in order to detect the BAO. We demonstrate that redshift accuracy of σ0 = 10-2 at z = 1 and the catastrophic failure rate of ffail ? 30% are sufficient for a reliable detection of BAO in future X-ray surveys. Spectroscopic quality redshifts (σ0 = 10-3 and ffail ~ 0) will boost the confidence level of the BAO detection by a factor of ~2. For meaningful detection of BAO, X-ray surveys of moderate depth of Flim ~ few 10-15 erg? s-1/cm2 covering sky area from a few hundred to ~ten thousand square degrees are required. The optimal strategy for the BAO detection does not necessarily require full sky coverage. For example, in a 1000 day-long survey by an eROSITA type telescope, an optimal strategy would be to survey a sky area of ~9000 deg2, yielding a ~16σ BAO detection. A similar detection will be achieved by ATHENA+ or WFXT class telescopes in a survey with a duration of 100 days, covering a similar sky area. XMM-Newton can achieve a marginal BAO detection in a 100-day survey covering ~400 deg2. These surveys would demand a moderate-to-high cost in terms the optical follow-ups, requiring determination of redshifts of ~105 (XMM-Newton) to ~3 × 106 objects (eROSITA, ATHENA+, and WFXT) in these sky areas.

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## Keywords

Cosmology: theory, Galaxies: active, Large-scale structure of Universe, X-rays: galaxies