Mock Clusters README file - 22 Jun 2020 -

The following mock catalog of galaxy clusters is made available in the SIMPUT format to allow straight simulations of X-ray cluster surveys with the SIXTE tool (Dauser et al. 2019; see also https://www.sternwarte.uni-erlangen.de/research/sixte/ for all the technical details on SIXTE). Please refer to Marchesi et al. 2020 for additional information.

clusters_a1deg2_sixte.fits

The mock is generated from the predictions of dark matter haloes extracted from a numerical mass function for a given set of cosmological parameters: we use the mass functions of both Tinker et al. (2008) and Despali et al. (2016).
The number density is estimated in the M_500 mass range 1E12 - 4E15 M_sun in 200 redshift bins between z=0.03 and z=6 using the python code Colossus (Diemer 2018; http://www.benediktdiemer.com/code/colossus/). Then, it is integrated over the cosmological volume to recover the number of haloes expected at a given mass and redshift per square degree. We also associate to each considered mass value, M_500, its corresponding radius R_500 = M_500^1/3 / (4/3 *pi *500 *rho_cz)^1/3, where rho_cz = 3 H_0^2*E_z^2 / (8*pi*G) is the critical density of the Universe at a given redshift, and an X-ray luminosity and temperature as estimated from available scaling relations (Reichert et al. 2011).
We then use XSPEC to convert these X-ray luminosities into fluxes in the observed 0.5–2 keV band and in the corresponding surface brightness within R_500, including the effect of Galactic absorption, in units of erg/s/cm2/arcmin2.

IMPORTANT: to work within SIXTE, the names of column 1 to 10 should not be modified. The spectral library contained in the spectra_clusters.tar.gz archive needs to be unpacked in the same directory of the mock catalog. The beta.fits file describing the cluster profile also needs to be placed in the same directory.

Column description

Column 1: SRC_ID. Numerical identifier.

Column 2: RA. Source Right Ascension. It ranges between -0.5 and 0.5 deg.

Column 3: DEC. Source Declination. It ranges between -0.5 and 0.5 deg.

Column 4: E_MIN. Lower energy boundary for the FLUX parameter (see column 6). This value is equal to 0.5 keV for all sources.

Column 5: E_MAX. Higher energy boundary for the FLUX parameter (see column 6). This value is equal to 2 keV for all sources.

Column 6: FLUX. Observed source flux in the energy range described by the E_MIN and E_MAX columns. This parameter is then used as an input for the SPECTRUM parameter (see column 7).

Column 7: SPECTRUM. Spectrum associated to the source. The full spectral library is contained in the spectra_clusters.tar.gz archive. In the XSPEC formalism the baseline model is: *phabs*apec*.
- *phabs* is the Galactic absorption (set to 1.8E20 cm-2).
- *apec* models the thermal emission from a gas with temperature kT and metallicity Z at redshift z. The metallicity value is fixed to 1 (i.e., Solar): kT is reported in Column 16, while the spectra used in this work are quantized in redshift with Delta-z=0.1. The redshift in the spectrum is the closest to the one reported in Column 11.

Column 8: IMAGE. This column describes the extended shape of the source. For all sources, we use a Beta model (beta.fits): the extension of the model is parameterized by IMGSCAL (column 10).

Column 9: LIGHTCUR. This column can be used to associate to the source a variability profile. This mock does not include variability effects, so the value is set to NULL.

Column 10: IMGSCAL. Inverse of the linear scaling factor for extended sources, computed as 0.165/R_200. R_200 is expressed in arcminutes and is reported in Column 15.

Column 11: z. Source redshift.

Column 12: M_500. Mass of the cluster (in M_sun) within a radius R_500.

Column 13: R500/arcmin. R_500 of the cluster, in arcminutes.

Column 14: R200. R_200 of the cluster, in arcminutes. R_200 is computed from R_500, being R_200=1.53846*R_500.

Column 15: T/keV. Temperature of the cluster (in keV).

Column 16: Lbol. Intrinsic bolometric luminosity of the source in erg/s.

Column 17: f_noABS_0.5_2. Observed 0.5-2 keV flux of the source, in units of erg/s/cm2.

Column 18: S_0.5_2. Surface brightness of the source, in units of erg/s/cm2/arcmin2.