POSTER: Uncertainties in emission-line diagnostics from X-ray Integral-Field Unit observations of galaxy clusters

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We present a simple analytical treatment of the variance associated to common turbulence estimators extracted from integral-field unit (IFU) data: line centroid shifts, line widths and structure functions, in direct continuation of previous works by e.g. Zhuravleva et al. (2012, MNRAS 422, 2712) ; ZuHone et al. (2016, ApJ 817, 110). We focus on the so-called 'sample variance', originating from the stochastic nature of the Kolmogorov turbulence and the finite number of individual objects/regions of sky accessible to an observer. This extra uncertainty restricts our ability to infer the underlying properties of the turbulent velocity field in astrophysical objects, such as the hot atmospheres of galaxy clusters seen in X-rays.

Our model enables rapid derivation of the so-called 'sample variance' affecting line-of-sight measurements, without a need for costly and CPU-intensive Monte-Carlo simulations. A validation of our results based on 'toy-model' simulations of nearby clusters is shown. It relies on the characteristics of the Athena/X-IFU instrument (2.5 eV FWHM energy resolution, 5 arcsec spatial resolution over a 5 arcmin equivalent field-of-view). Our model will help in the design of the galaxy cluster samples to be observed with future X-ray IFU instrumentation with an aim to constrain the power-spectrum of turbulent velocities in the intra-cluster medium.