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Automated Redshift estimation from X-ray AGN spectra

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Abstract

Redshift is one of the crucial physical parameters for understanding AGN physics. Photometric redshifts are easy to obtain, but they have a high uncertainty. However, spectroscopic redshifts are more reliable and accurate, but obtaining them is an expensive process. We have developed a novel automated algorithm to extract redshift information solely from X-ray AGN spectra. This technique was developed taking advantage of the prominent FeKα line at a rest-frame energy of E $\sim$ 6.4 keV. We employ wavelet techniques for denoising the spectra before the redshift determination process. To test the efficiency of our automated algorithm, we use simple power-law spectra with a Gaussian line. Using the representative shapes of the local AGN spectra from our previous work (Koushika et al., 2025), we calculated the different rest-frame equivalent widths. Simulations were performed using these different rest-frame equivalent widths in the redshift range of z = 1-4, log L_X 2-10 keV = 43.5, 44.5, and 45.5 log (erg/s), and a 200 ks exposure time. This allowed us to control the signal-to-noise ratio (SNR). These simulated spectra were then fed into the automated redshift-estimating algorithm to recover the redshifts. In this preliminary work, we found that we were able to recover the redshift with less than 5% error for 71% of our simulated sample and less than 1% error for 59% of the simulated sample. We also learned that we have to optimize our algorithm for lower SNR values and low rest-frame equivalent widths. The ultimate aim is to use our algorithm on the representative spectral shapes from our previous work, which we will simulate using NewAthena/WFI matrices emulating the serendipitous survey data.