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Determining Physical Parameters of Serendipitous Sources using AI

Galaxy groups are gravitationally bound structures composed of galaxies and a hot X-ray-emitting gas that envelops the entire group. These systems are balanced with gravitational potential pulling inwards and thermal pressure from the hot gas pushing outwards. Questions remain about how this balance is altered when galaxies within the group undergo periods of star formation or when supermassive black holes at the centers of some group galaxies become active and outburst. Identifying galaxy groups at very large distances with the next generation of X-ray observatories can help to answer these questions. Doing so with conventional methods is computationally expensive. We are using simulated data from the line emission mapper (LEM), a next-generation X-ray probe for high spectral resolution survey observations targeting galaxies and clusters of galaxies to characterise the circumgalactic and intergalactic medium better. Our initial results from training a CNN accurately and quickly identify galaxy groups' distance, age, mass, and chemical composition based on simulated high-resolution X-ray spectra. This allows us to serendipitously identify galaxy groups in the background of observations of other astronomical sources.

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