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Unlocking Galactic Mysteries: Machine Learning Analysis of Gaia DR3 Data Reveals New C-rich and O-rich AGB Stars

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AGB stars play a pivotal role in understanding galactic populations, producing essential elements such as carbon, oxygen, and nitrogen. Despite their significance, unresolved questions persist regarding their evolution, including the transition from oxygen-rich to carbon-rich states and the impact of mass loss. The recent release of Gaia DR3 presents a remarkable opportunity to expand the sample of C-rich and O-rich AGB stars. Leveraging machine learning, our study aims to classify AGB stars based on the Gaia DR3 XP spectra, enhancing our understanding of galactic systems. Our methodology involves a two-step process: firstly, identifying AGB stars similar to Galactic AGB sources using cosine similarity; followed by classifying them as either C-rich or O-rich. This analysis utilizes a dataset of 220 million Gaia DR3 XP spectra, integrating photometric and spectroscopic data. Our presentation will detail this methodology, showcasing how machine learning efficiently handles massive datasets like Gaia DR3. This approach not only enriches our understanding of AGB stars but also presents opportunities to broaden statistical samples of other celestial objects in the Milky Way.

Primary author: Ms KUSHWAHAA, Tanya (Cardiff University)

Presenter: Ms KUSHWAHAA, Tanya (Cardiff University)

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