Contribution ID: **39** Type: **not specified**

Merger identification through photometric bands, colours, and their errors

Thursday 27 April 2023 14:25 (15 minutes)

On our research we attempt to identify galaxy mergers in modern galaxy surveys. The main results we want to show in this presentation is how we used Machine Learning (ML) to learn a previously unknown photometric property of galaxy mergers.
We built a Neural Network that we trained on photometric measurements from SDSS, using a class-balanced dataset composed by mergers from Darg et al. (2010) and non-mergers from galaxies with low merger vote fractions in Galaxy Zoo. These sources were extracted from SDSS DR6 and GZ DR1. The result of the NN training showed that we could use the error in the sky background estimation to find them, achieving a 92.6 ± 0.2 % training accuracy in the validation set and 92.4 ± 0.2 % in the test set. Further analysis of the data showed that, by plotting this sky background error in the g versus r bands plane, a clear separation between mergers and non-mergers is revealed. By drawing a decision boundary a 91.6 % accuracy was achieved. Our interpretation is that it seems that the sky error traces the low S/N material tidally stripped by the merging interactions. This work shows not only an example of the strength of ML methods in galactic evolution studies but also the scientific interest in the interpretation of these methods internal properties. The paper on which this work is based has been published in A&A (https://arxiv.org/abs/2211.07489). Moreover, further research has been done on understanding how the sky error behaves in a dataset less ideal than the initial training set, showing how much contamination by blending sources or visual pairs can be expected using SDSS DR6 and GZ DR1.

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Session Classification: Extragalactic astrophysics and cosmology