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Tracing ongoing quenching in jellyfish galaxies with machine learning techniques: Challenges in full spectral classification

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Jellyfish galaxies display long tails of gas that was removed from their stellar disks through a process known as ram pressure stripping. These objects represent a fast transition phase between star-forming and post-starburst/quiescent galaxies. Using spatially resolved spectroscopic information, one can trace this evolution by identifying quenched regions in jellyfish galaxies and studying their properties and spatial distribution. This has been done through visual inspection in select cases where the relevant spectral features are particularly prominent, but extending this analysis to a statistical sample requires the classification of spatially resolved spectra of varying S/N in a large wavelength range that is coeval between different objects, accounting for the displacement of spectral features caused by redshift and internal kinematics. To this end, we developed a pipeline for the selection of a training set and the full spectral classification of star-forming and quenched galaxy spectra with 774 fluxes between 3680 and 6000 angstroms using a 1D convolutional neural network, which accounts for the displacement of spectral features. Similar results can be obtained with other techniques but require the spectra to be heavily smoothed. The classification is applied to a sample of 21 Jellyfish galaxies, revealing ongoing quenching in 6 objects, which is confirmed through visual inspection and stacking. The quenched regions are generally found to be opposite to the tail, with the exception of one object that displays outside in quenching. We show that the central regions of galaxies with ongoing quenching have enhanced star-formation rates with respect to other jellyfish galaxies and to a control sample, showing how the outside-in stellar population gradients found in post-starburst galaxies are shaped during the stripping process.

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