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Beyond Diagnostic Diagrams: Spectral Decomposition of Ionizing Sources in MaNGA

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Star formation rates (SFR) and gas-phase metallicities in galaxies are usually measured from strong nebular emission lines under the assumption that young massive stars are the only source ionizing the gas. In galaxies hosting an active galactic nucleus (AGN), or containing old stellar populations, harder radiation also produces these lines, so the standard approach is to classify each region with emission-line diagnostic diagrams and discard anything not purely star-forming. In the MaNGA integral field spectroscopy survey, more than half of the spatially resolved spectra (spaxels) passing our quality cuts fall outside the star-forming region. We apply a deep convolutional neural network that decomposes the full spectrum of each spaxel into a star-forming and a non-star-forming component, for roughly 740,000 spaxels across 6,500 galaxies, and fit each decomposed component for both emission lines and continuum.

The decomposition can be used in two complementary ways. In star-forming regions, it acts as a correction by removing any residual non-star-forming contamination. We use this technique to reconstruct key galaxy scaling relations and find that the corrections are small. In composite and AGN-dominated regions, it isolates any underlying star formation. We confirm that $H\alpha$ -based SFR is substantially overestimated in AGN-classified spaxels, and find that metallicity corrections depend on the type of ionizing source. We demonstrate that this decomposition can be used to extend classical calibrations to regions that are usually discarded in population-level studies, and to further our understanding of how AGN activity connects to star formation and chemical enrichment in galaxies.

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No

If you are selected for a poster, would you be interested in giving a short flash talk on your work?

Yes

What is your career level?

MSc

Which keyword describes the area of focus of this talk?

Galaxies

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