

Validity of abundances derived from spaxel spectra of the MaNGA survey

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Abstract

© ESO 2018. We measured the emission lines in the spaxel spectra of Mapping Nearby Galaxies at Apache Point Observatory (MaNGA) galaxies in order to determine the abundance distributions therein. It has been suggested that the strength of the low-ionization lines, R2, N2, and S2, may be increased (relative to Balmer lines) in (some) spaxel spectra of the MaNGA survey due to a contribution of the radiation of the diffuse ionized gas. Consequently, the abundances derived from the spaxel spectra through strong-line methods may suffer from large errors. We examined this expectation by comparing the behaviour of the line intensities and the abundances estimated through different calibrations for slit spectra of H II regions in nearby galaxies, for fibre spectra from the Sloan Digital Sky Survey, and for spaxel spectra of the MaNGA survey. We found that the S2 strength is increased significantly in the fibre and spaxel spectra. The mean enhancement changes with metallicity and can be as large as a factor of 2. The mean distortion of R2 and N2 is less than a factor of 1.3. This suggests that Kaufmann et al.'s (2003, MNRAS, 346, 1055) demarcation line between active galactic nuclei and H II regions in the Baldwin, Phillips, & Terlevich (BPT, 1981, PASP, 93, 5) diagram is a useful criterion to reject spectra with significantly distorted strengths of the N2 and R2 lines. We find that the three-dimensional R calibration, which uses the N2 and R2 lines, produces reliable abundances in the MaNGA galaxies. The one-dimensional N2 calibration produces either reliable or wrong abundances depending on whether excitation and N/O abundance ratio in the target region (spaxel) are close to or differ from those parameters in the calibrating points located close to the calibration relation. We then determined abundance distributions within the optical radii in the discs of 47 MaNGA galaxies. The optical radii of the galaxies were estimated from the surface brightness profiles constructed based on the MaNGA observations.

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Keywords

abundances, Galaxies, ISM, spiral

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