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Unveiling gas kinematics and stellar populations in HII regions inside the low-metallicity dwarf nearby galaxy SDSSJ0859+3923 with MEGARA at the GTC

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Abstract

In this study, we present Integral Field Unit observations of the galaxy SDSSJ0859+3923, utilizing the MEGARA instrument on the GTC 10.4m telescope. These observations were conducted in two distinct spectral ranges: 4332 – 5222 Å and 6097 – 7345 Å, with a high resolving power ($R_{FWHM} \sim 6\,000$), and spatial resolution of 25 pc, considering the galaxy's distance of 8.5 Mpc. Our observations have identified five HII regions, whose precise positions were determined using data from the FWFC3-UVIS/HST archive images, where we also detected the associated blue underlying continuum linked to the ionized knots. A detailed kinematic analysis of these regions revealed low velocity dispersion values (around $10\,\mathrm{km\,s^{-1}}$) in four HII regions, indicating a lack of significant turbulent events. In the fifth region we observed a peak in velocity dispersion reaching $40\,\mathrm{km\,s^{-1}}$, which we interpret as the result of hot star winds and/or a recent type-II supernova explosion. We have conducted a comprehensive spectral analysis of the HII regions, obtaining emission-line fluxes that enabled us to confirm the oxygen abundance ($12 + \log(\mathrm{O/H}) = 7.41 \pm 0.15$) and, using POPSTAR models, to constrain the age and mass of the ionizing young clusters.

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