

# The Andromeda Veil: Combining MEGARA and JAST80 to probe the nature of a faint nebula towards M31

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## Abstract

A new large nebula near the Andromeda galaxy (M31) was recently discovered by amateur astronomers (Dreshler et al. 2023) using very deep exposures with an [O III]5007 filter. If it belonged to the M31 system, this would represent a huge physical structure, only comparable to quasar ionization echoes. An alternative hypothesis would place the object within our Galaxy (and thus much smaller), simply located by chance at a small projected angular distance from M31.

In order to discern between these two possibilities, and to explore the physical properties of the nebula, we requested spectroscopic observations with the MEGARA IFU at the GTC and narrowband photometric imaging with the JAST80 in the Javalambre Astrophysics Observatory (OAJ). MEGARA was pointed at four positions within the nebula, collapsing all the IFU fibers into a single 1D spectra per pointing. This allowed us to detect multiple emission lines, including the faintest ones (H $\beta$ , [N II], [S II], ...). The typical receding velocities measured in [O III] ( $\sim -15$  km/s), with similar values in different parts of the nebula, are far more consistent with a nebula inside our galaxy rather than an exceptionally large one near M31.

With the wide area covered by the JAST80 observations, and reaching very low surface brightness in both the [O II]3727 and H $\alpha$  filters, we identified an offset in the spatial distribution between those lines and the [O III]5007 flux. Moreover, the velocity inferred from hydrogen emission lines (H $\alpha$ , H $\beta$ ) is significantly different ( $\sim 20$  km/s) from the velocity of the [O III] lines. These results may indicate an ionizing front advancing through a likely multiphase interstellar medium, consistent with a supernova remnant. Nevertheless, the source of the ionization remains unknown.

My poster in zenodo.org can be found here