

Investigating AGN activity in a sample of isolated late-type galaxies

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References



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Introduction: Isolated galaxies provide a valuable laboratory to study the internal processes that shape galaxy evolution (Rampazzo et al. 2016). The extraplanar diffuse ionised gas (eDIG), whose ionisation source remains uncertain, may result from galaxy interactions or from internal feedback linked to star formation or AGN activity (Ho et al. 2016). While the growth of active galactic nuclei (AGN) is often associated with interactions that drive gas toward the nucleus (Hopkins et al. 2006), their presence in isolated systems suggests that alternative triggering mechanisms can also operate (Sabater et al. 2012).

Goal: We aim to identify the ionising sources in a sample of nearby isolated late-type edge-on galaxies, focusing on whether the ionisation responsible for eDIG, when present, is driven by star formation or nuclear activity.

Methodology: We analysed long-slit optical spectra from Observatorio Astronómico Nacional de San Pedro Mártir (OAN-SPM), México, for 12 galaxies from the Catalogue of Isolated Galaxies (CIG, Karachentseva 1973), for which no previous spectroscopic data were available. The sample includes systems both exhibiting and lacking eDIG features identified in Fabry-Perot H α data (Sardaneta et al. 2024, 2025). Emission-line ratios were measured and used in Baldwin-Phillips-Terlevich (BPT; Baldwin et al. 1981; Kewley et al. 2001) and WHAN (Cid Fernandes et al. 2010) diagnostic diagrams to classify the dominant ionisation mechanisms.

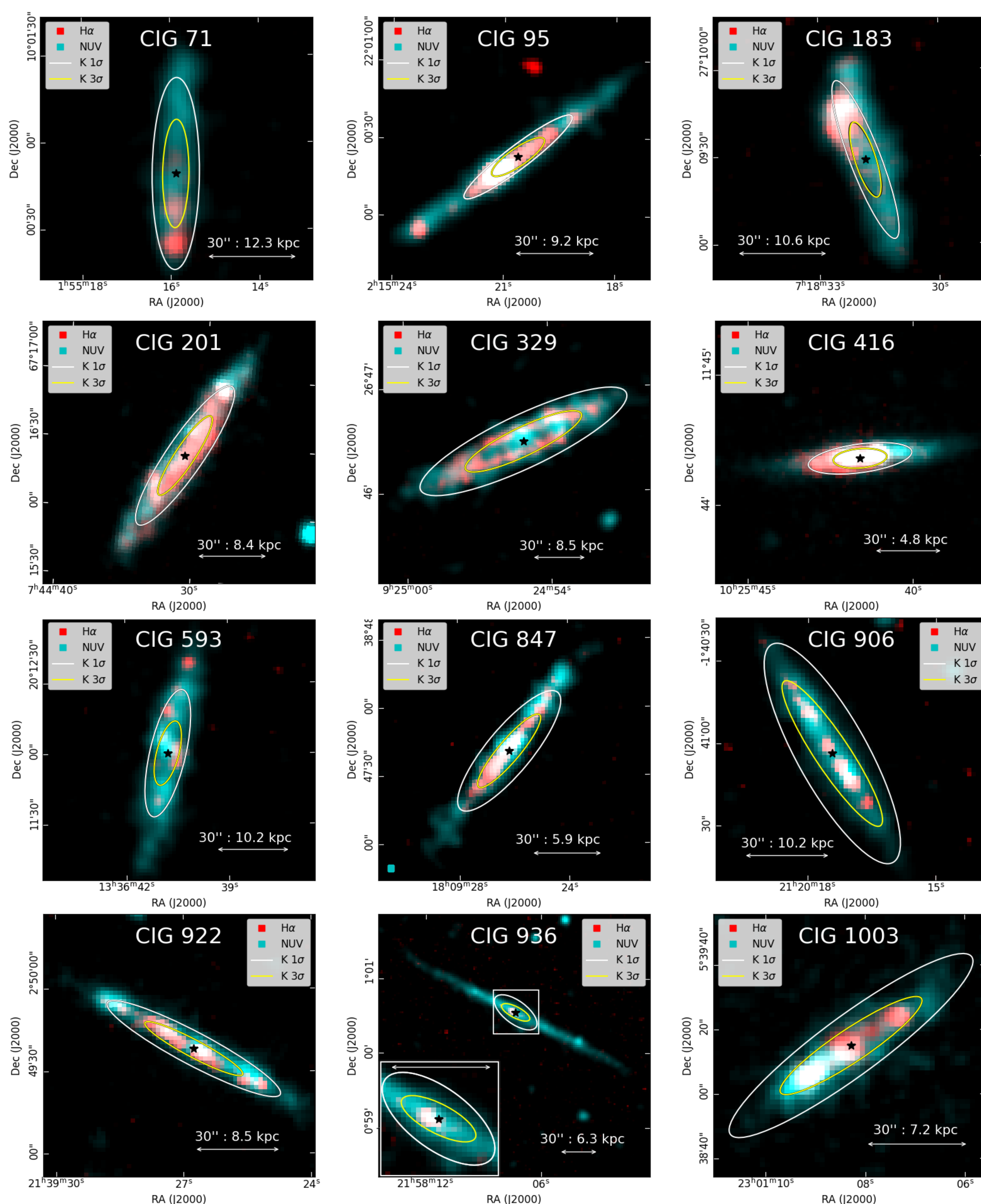


Figure 1. Superposition of FP H α monochromatic map and GALEX NUV image of the galaxies in our sample. The ellipses fitted to the surface brightness level at 1σ and 3σ of the typical background noise of the respective 2MASS K s-band image are overlaid to represent the old stellar population disc. Image adapted from Sardaneta et al. (2024).

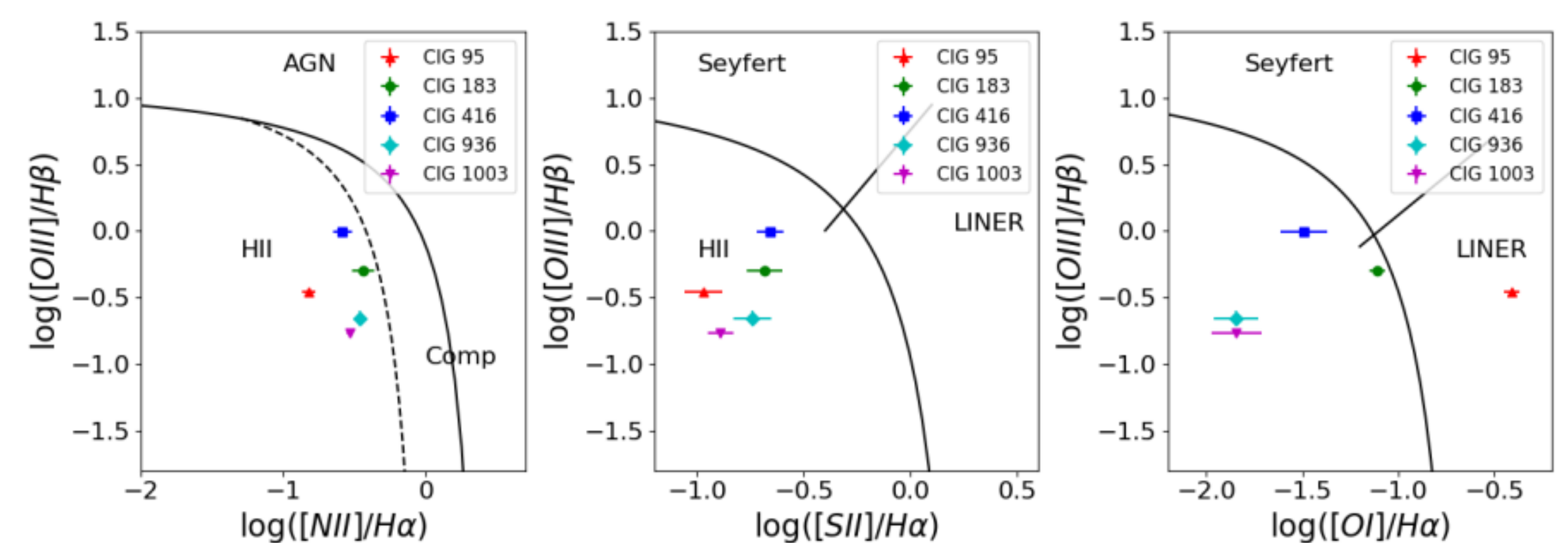


Figure 2. BPT diagnostic diagram classifying galaxies in the isolated late-type sample when emission lines were available.

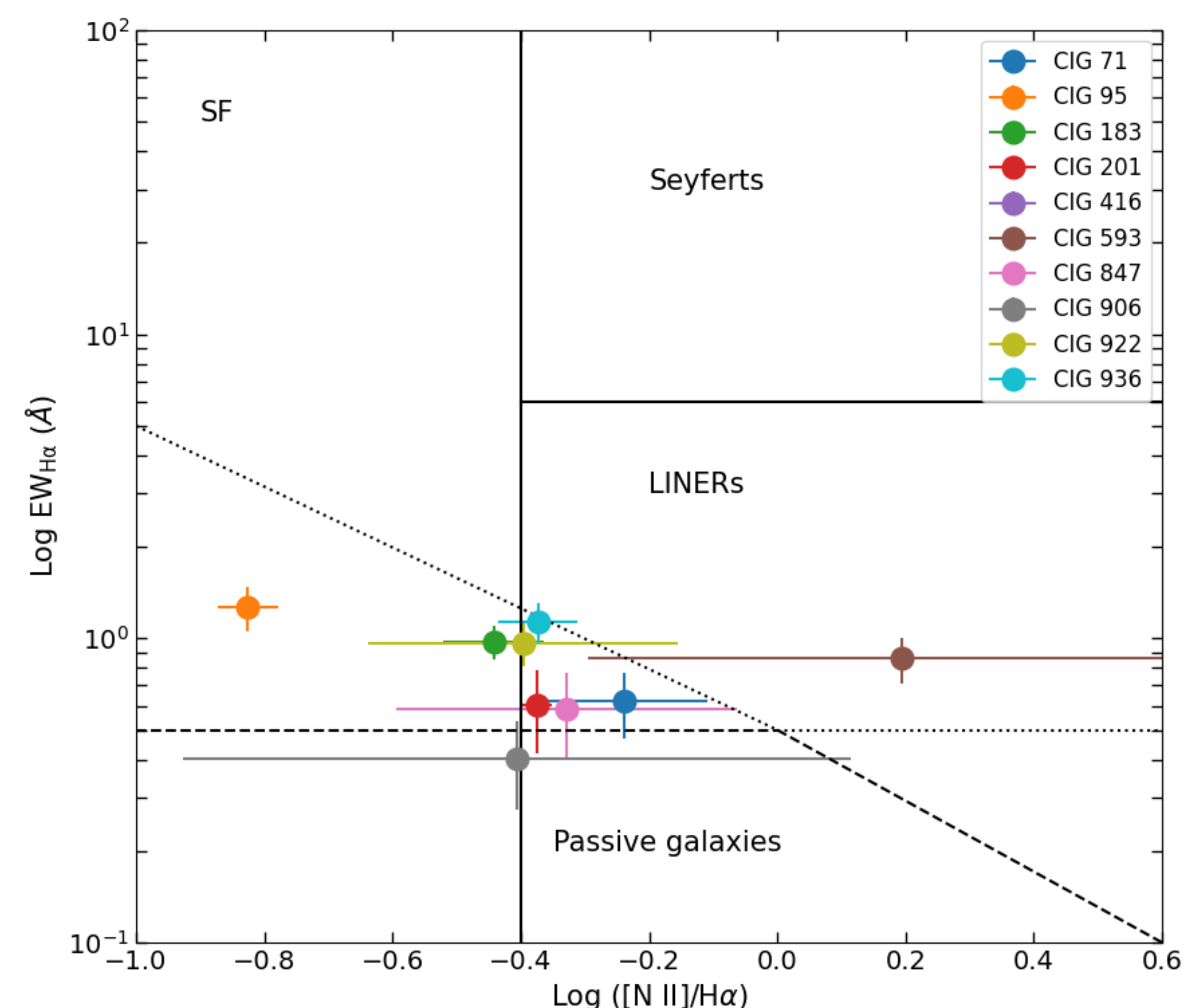


Figure 3. WHAN diagnostic diagram (Cid Fernandes et al. 2010) classifying galaxies of our sample as an alternative diagnostic method when emission lines are not available to place the galaxies on the BPT diagram.

Preliminary results: Galaxies exhibiting eDIG tend to show WHAN line ratios in the LINER/retired regime. This association indicates that the eDIG in isolated systems may be powered by low-ionisation sources, either weak AGN or the hot low-mass evolved stellar population (HOLMES), rather than pure star formation. Consistently, most objects remain star-forming in the BPT but shift to the LINER/retired region in the WHAN diagram, because their low H α equivalent widths reflect weak, diffuse ionisation typical of extraplanar gas or HOLMES rather than active nuclei.

Conclusions: Isolated galaxies provide key laboratories to study AGN triggering and feedback driven purely by internal mechanisms. The observed connection between eDIG and LINER-like emission supports a scenario in which low-ionisation sources, such as weak AGN or HOLMES, dominate the ionisation in these systems.

Acknowledgements: Based upon observations carried out at the Observatorio Astronómico Nacional on the Sierra San Pedro Mártir (OAN-SPM), Baja California, México. M.M.S acknowledges partial support from ANID, Chile, through FONDECYT grant No. 3250253 and from the DGAPA-UNAM Postdoctoral Fellowship awarded for 2022-2024. M.M.S. and M.R. acknowledges the project CONACyT CF-86367. This work is based on the undergraduate thesis conducted by L. Vidal-Medina and supervised by M. M. Sardaneta. at the Facultad de Ciencias, UNAM, publicly available via DGB-UNAM website.

