

The Inner Region of NGC 1316 through S-PLUS + ALMA

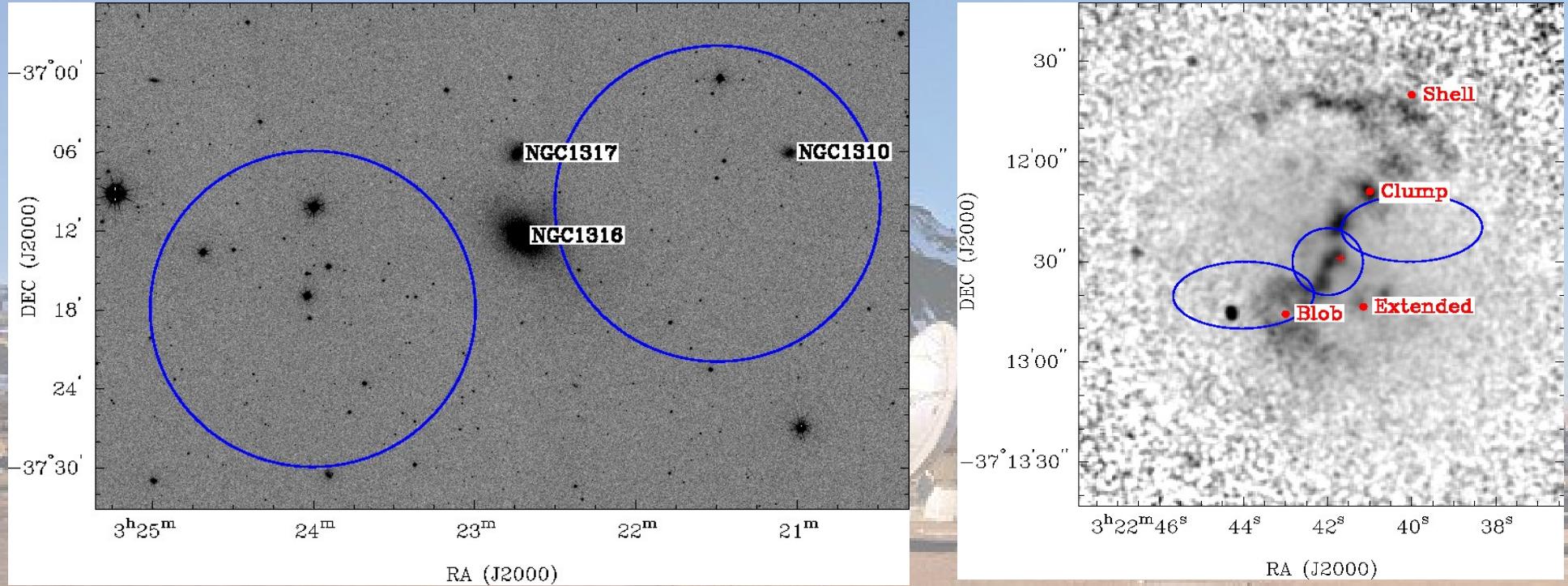
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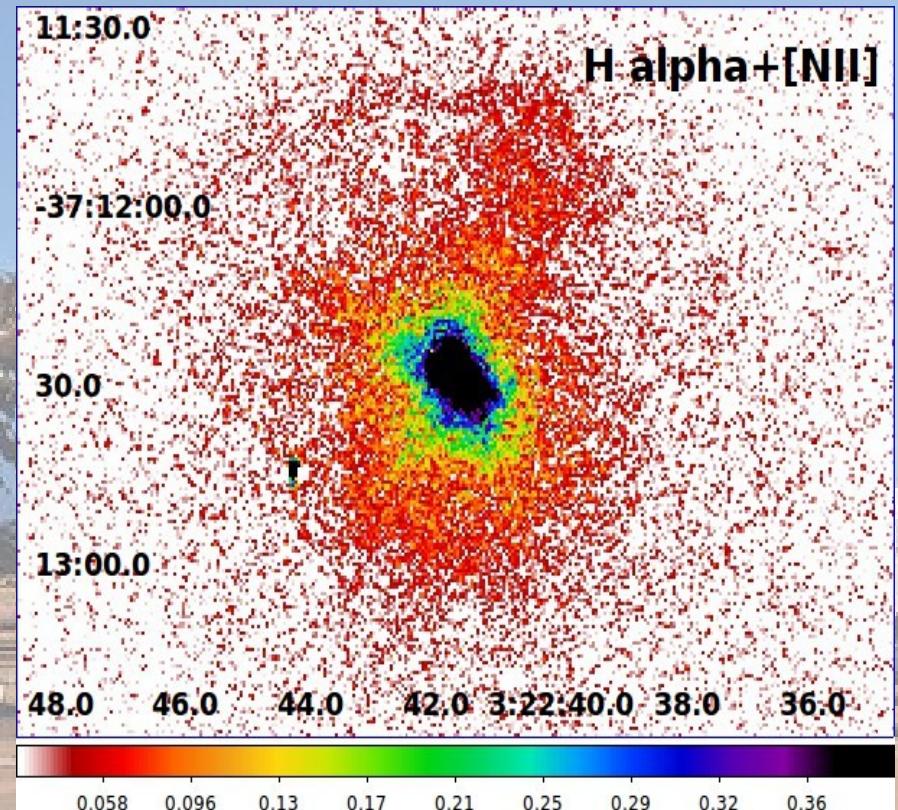
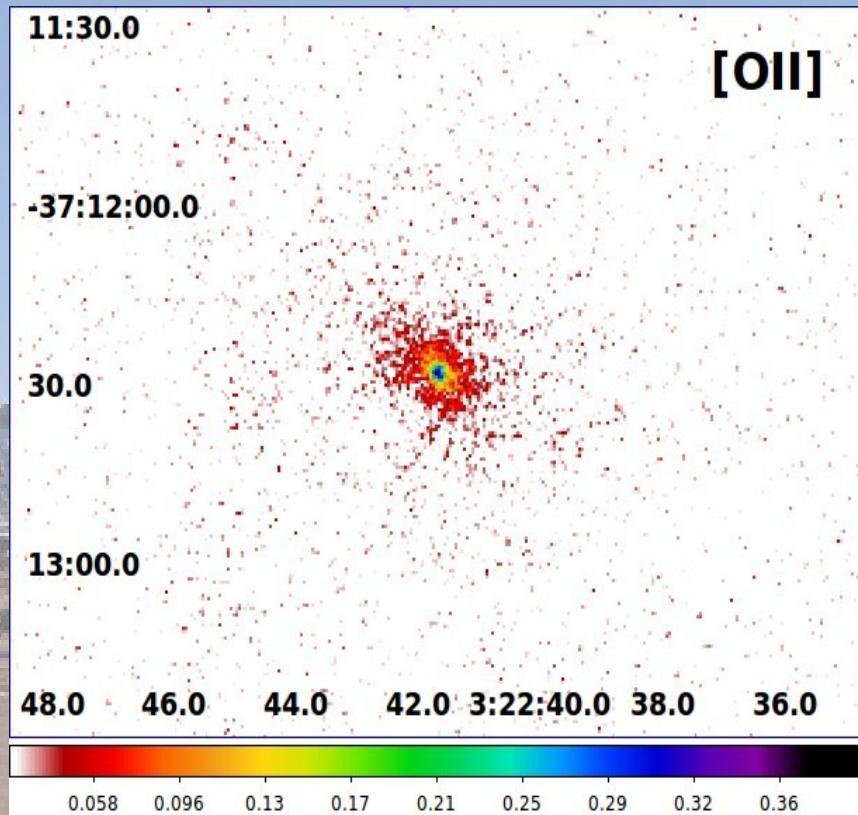
The NGC 1316 galaxy



Left panel: S-PLUS g-band image of NGC 1316 and its nearest bright neighbours. The blue circles represent the radio continuum detection at $\lambda=20$ cm (Fomalont+ 1989). The NGC 1310 galaxy is located in the foreground of the western radio lobe.

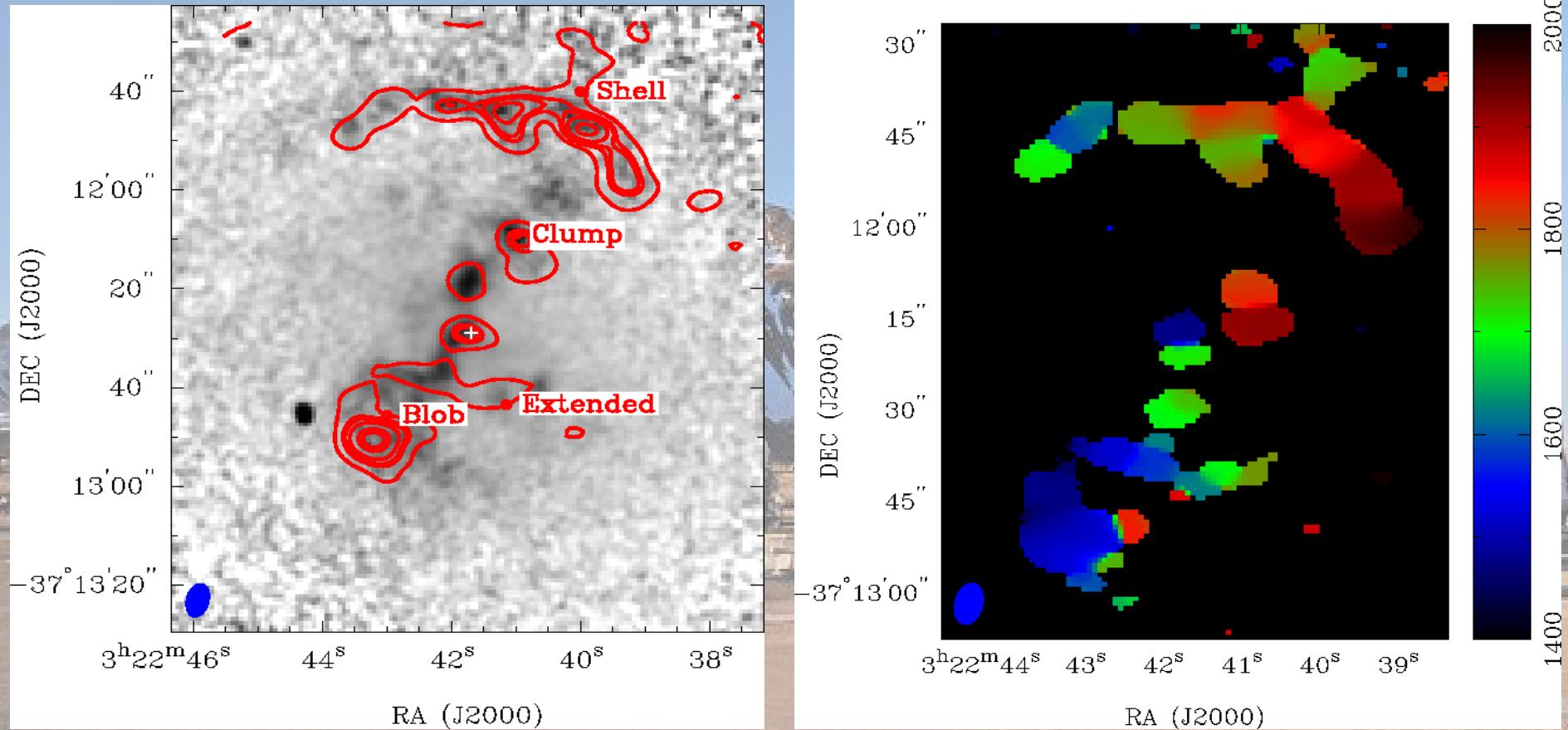
Right panel: S-PLUS (g-i) map of the central region of NGC 1316. The blue circle and ellipses represent the central radio continuum detection at 1.44 GHz by MeerKAT (Maccagni+ 2020).

S-PLUS [OII] and H α +[NII] emission



Continuum subtracted J0378 (**left**) and J0660 (**right**) images of the central region of NGC 1316. The detected [OII] peak emission matches the center of the galaxy and covers a radius of 15" (1.5 kpc at the assumed distance of 20 Mpc to NGC 1316). The detected H α +[NII] emission is much more extended, covering a radius of 1' (6 kpc) centered on the galaxy. The H α +[NII] emission seems to slightly trace the northwest dust shell structure already identified in the literature.

ALMA CO intensity map and Velocity Field



Left panel: ALMA CO($J=2-1$) intensity map of the inner region of NGC 1316 overlaid onto the S-PLUS (g-i) map. The CO red contour levels are 2, 8, 15, 25, 30 Jy/beam km/s.

Right panel: velocity field of CO($J=2-1$) (the color wedge units are km/s) extracted from the ALMA image cube of NGC 1316. The systemic velocity of NGC 1316 is ~ 1720 km/s.

Preliminary Remarks

The S-PLUS (g-i) map of NGC 1316 show dust substructures embedded in the light of the galaxy. They were previously reported from deeper optical images and S-PLUS recover them with similar detail.

The ALMA data used here, traces the dust with greater detail than, for example, those used by Morokuma-Matsui+ 2019. We also detect a more complex CO velocity field than previously reported.

Questions:

Is the [OII] emission tracing the high-energy particle injection by the AGN in the core? Is the H α +[NII] detection associated, at least in part, with the jet? We can not rule out a star-formation origin for the H α +[NII] emission as it also traces the dust shell in the NW.

In addition, [OII] is more easily absorbed than H α +[NII] by dust, and S-PLUS J0378 filter might not be deep enough to detect all the [OII] present in the galaxy.

The **[OII] emission** detected by S-PLUS is comparable to that of the **kpc-core component** identified by Macagni+ 2020 **in the jet of Fornax A**.

The extension of the S-PLUS **H α +[NII] detection** is similar to **that of the whole jet**. Macagni+ 2020 suggests that the kpc-core is still being injected with high-energy particles from the AGN, while this is not currently happening in the jets.

Next Steps: improve the continuum subtraction and flux calibrate our emission images, and explore the photometric [OII]/H α +[NII] flux ratio to see if it helps to understand these emissions.

Gracias :D