

Exploring the neutral gas of galaxies in the Antlia cluster with MeerKAT

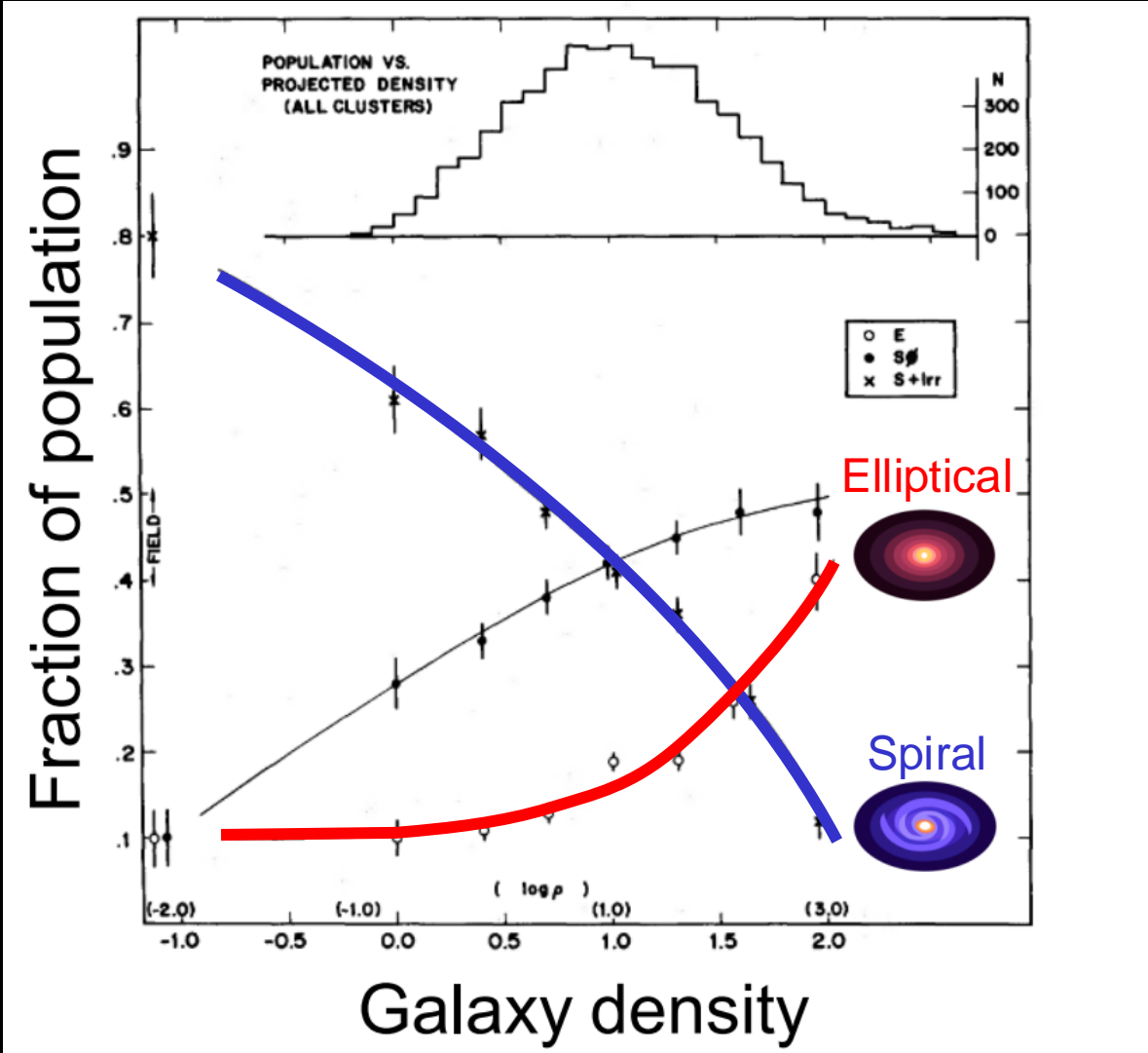
Presented by Vicente Salinas

PhD student, Department of Space, Earth and Environment,
Chalmers University of Technology,
Onsala Space Observatory (Sweden)
Supervised by: Kelley Hess

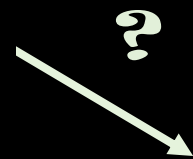
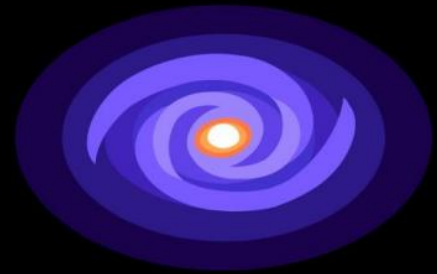


Image credit: Charles James Sharp

Galaxy evolution in dense environments



Spiral: blue and young stellar population



Elliptical: red and old stellar population

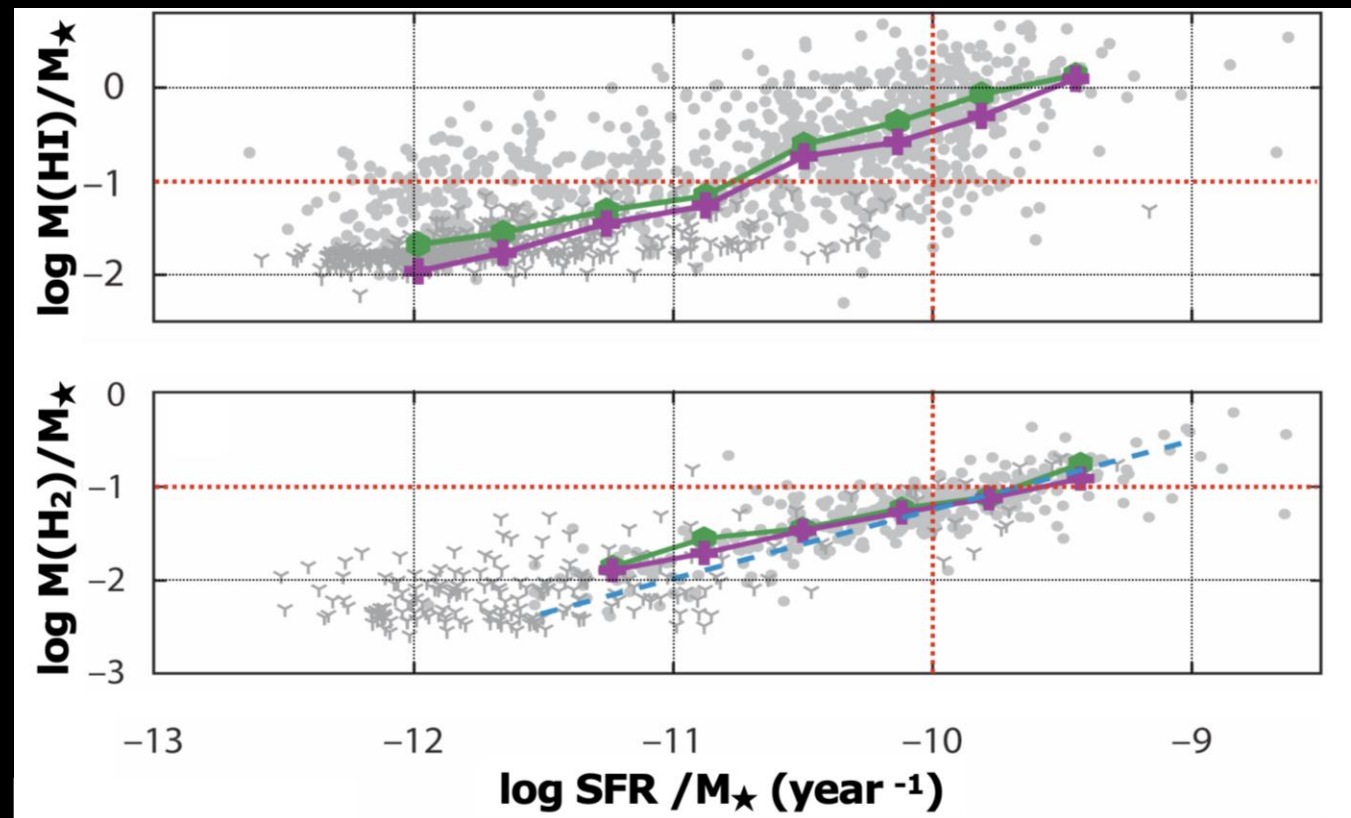
Dressler (1980)

The role of the neutral gas

The cold neutral atomic hydrogen (HI) provides the reservoir that fuels star formation.

Neutral
atomic gas

Molecular
gas



Saintongue & Cantinella (2022)

Star formation rate

Examples of evolution mechanisms

Gravitational interactions



Image credit: NASA / ESA / Hubble / M. Sun

Gas outflows



Image credit: ESO/WFI (Optical); MPIfR/ESO/APEX/A.Weiss et al. (Submillimetre); NASA/CXC/CfA/R.Kraft et al. (X-ray)

Ram pressure stripping

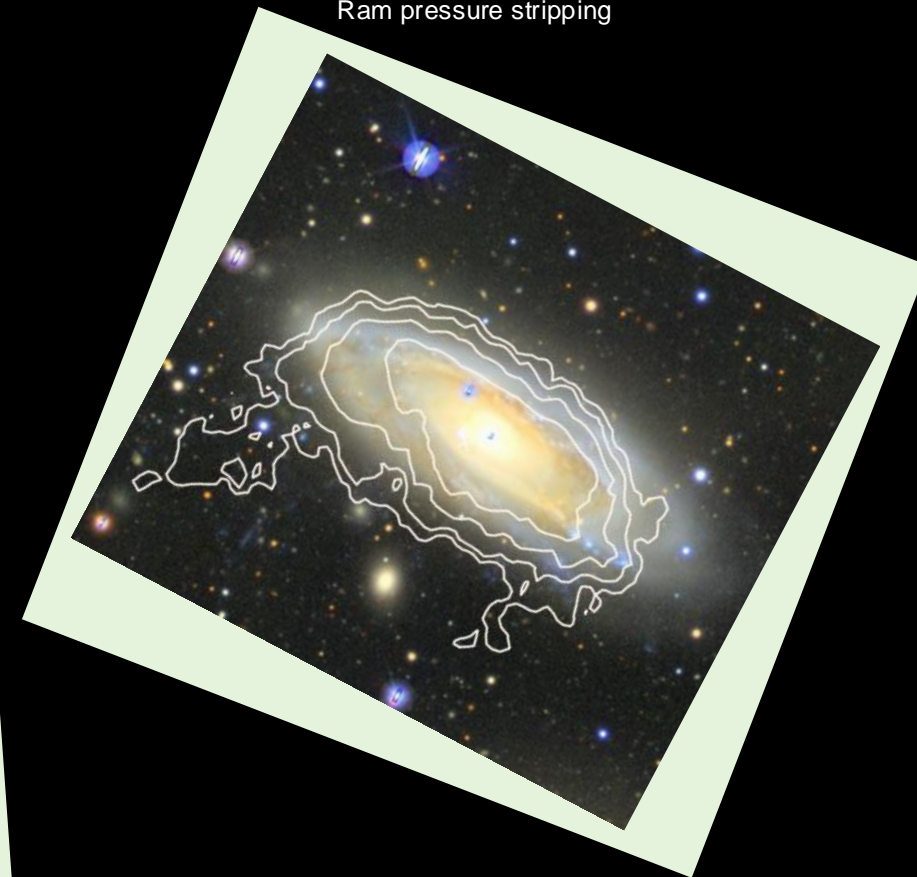


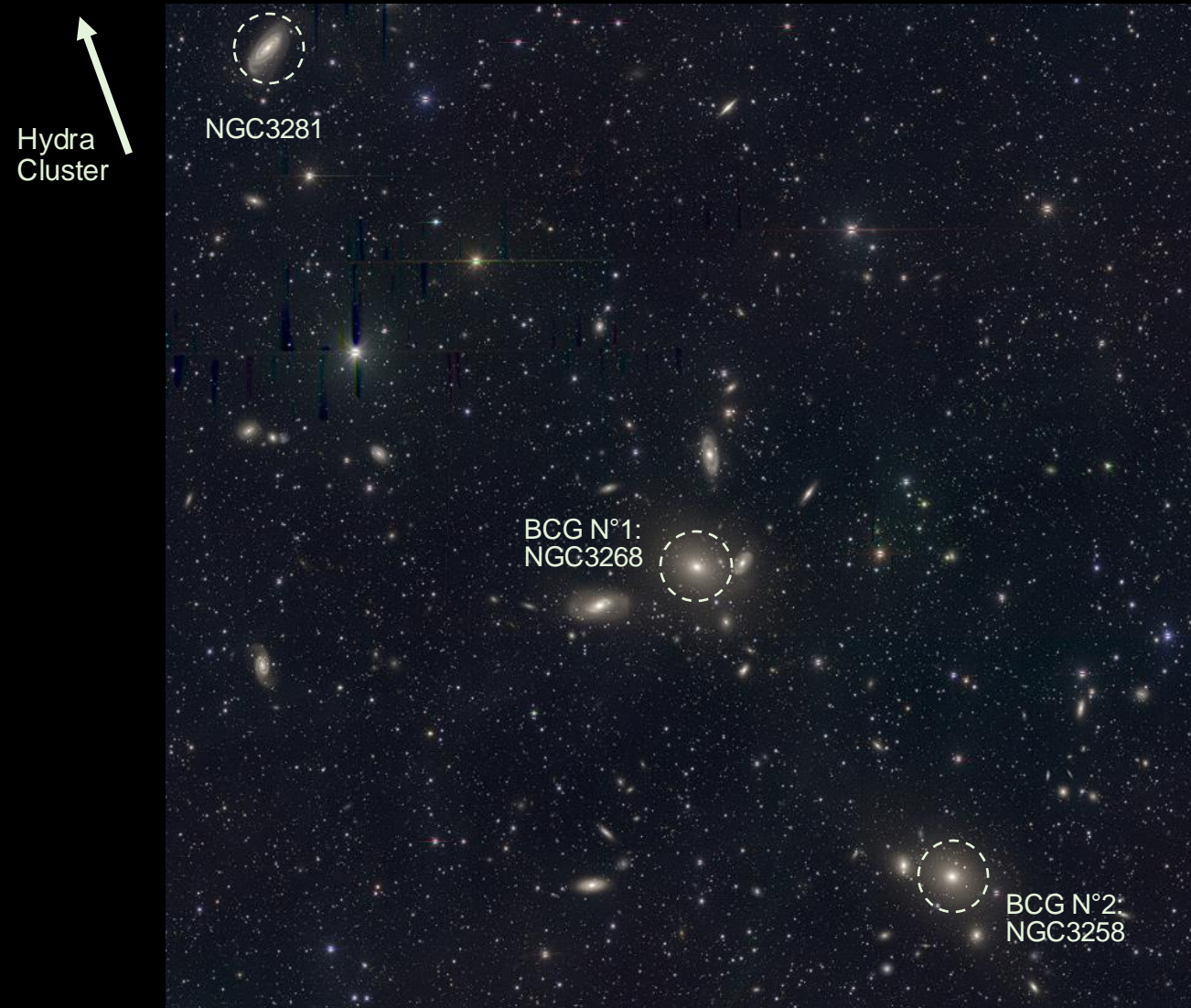
Image credit: DECam (optical); MeerKAT (radio) / Clara Cabanillas de la Casa

Current picture of cluster galaxy evolution



Image credit: Cortese et al. (2021)

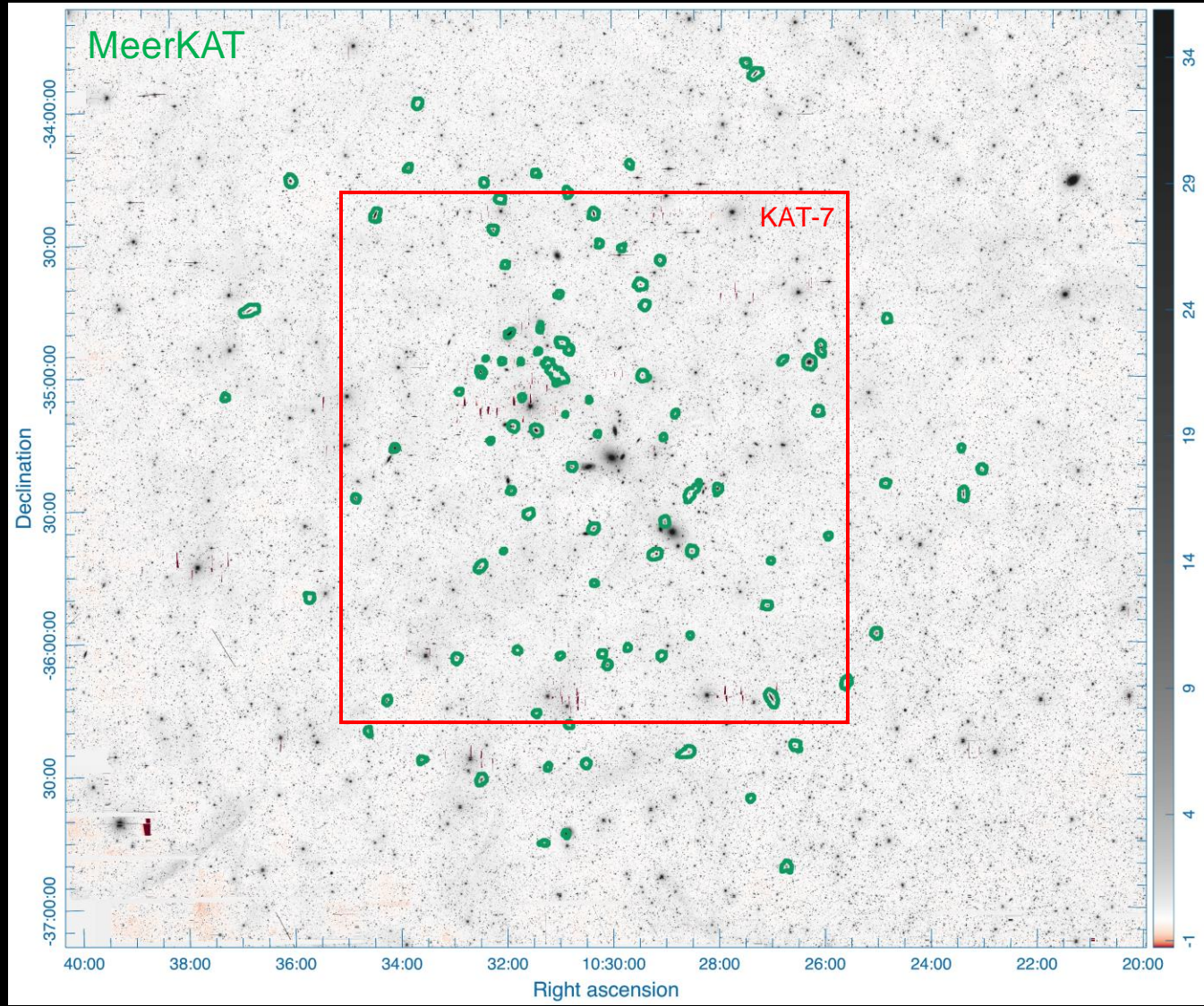
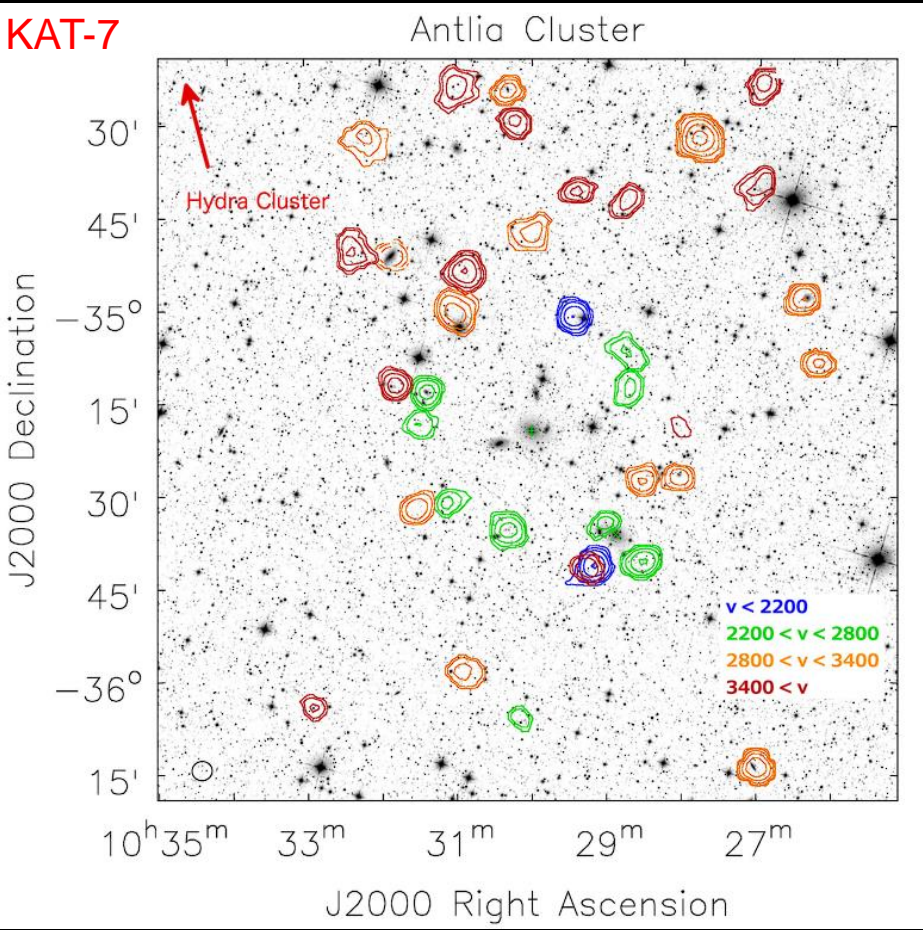
The Antlia cluster



- 3rd nearest cluster (~ 40 Mpc).
- Hydra's southern neighbor.
(See Clara's talk)
- Unrelaxed.
- Low mass cluster ($\sim 10^{14} M_{\odot}$).

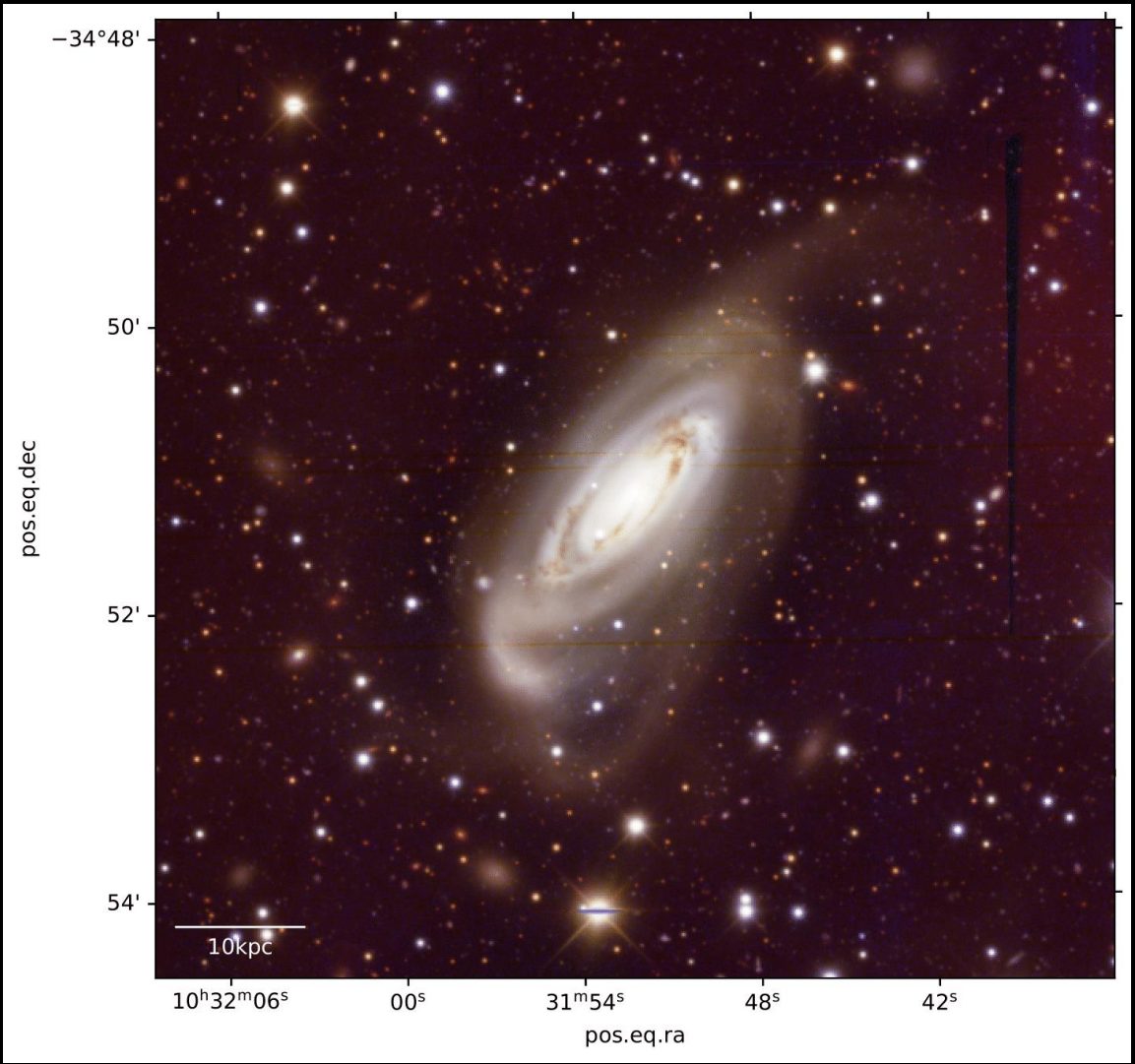
Image credit: Ralf Kotulla

Antlia in HI: KAT-7 vs MeerKAT



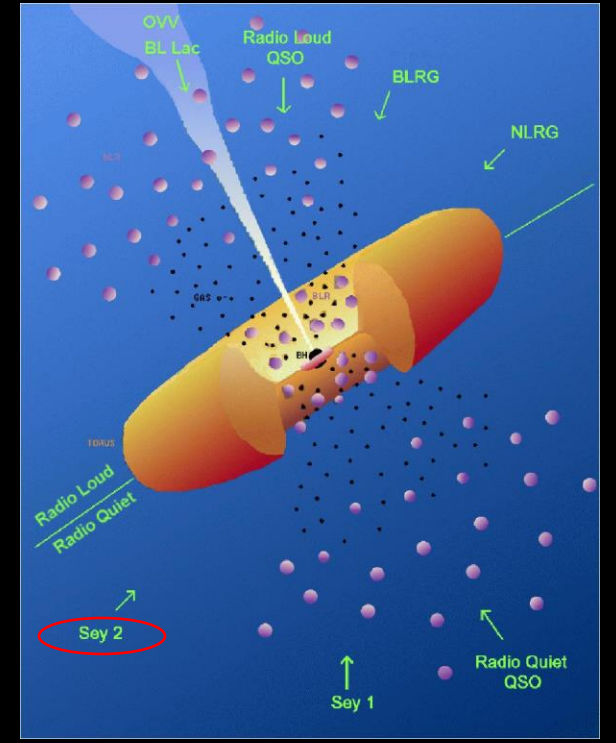
Hess et al. (2015)

NGC3281

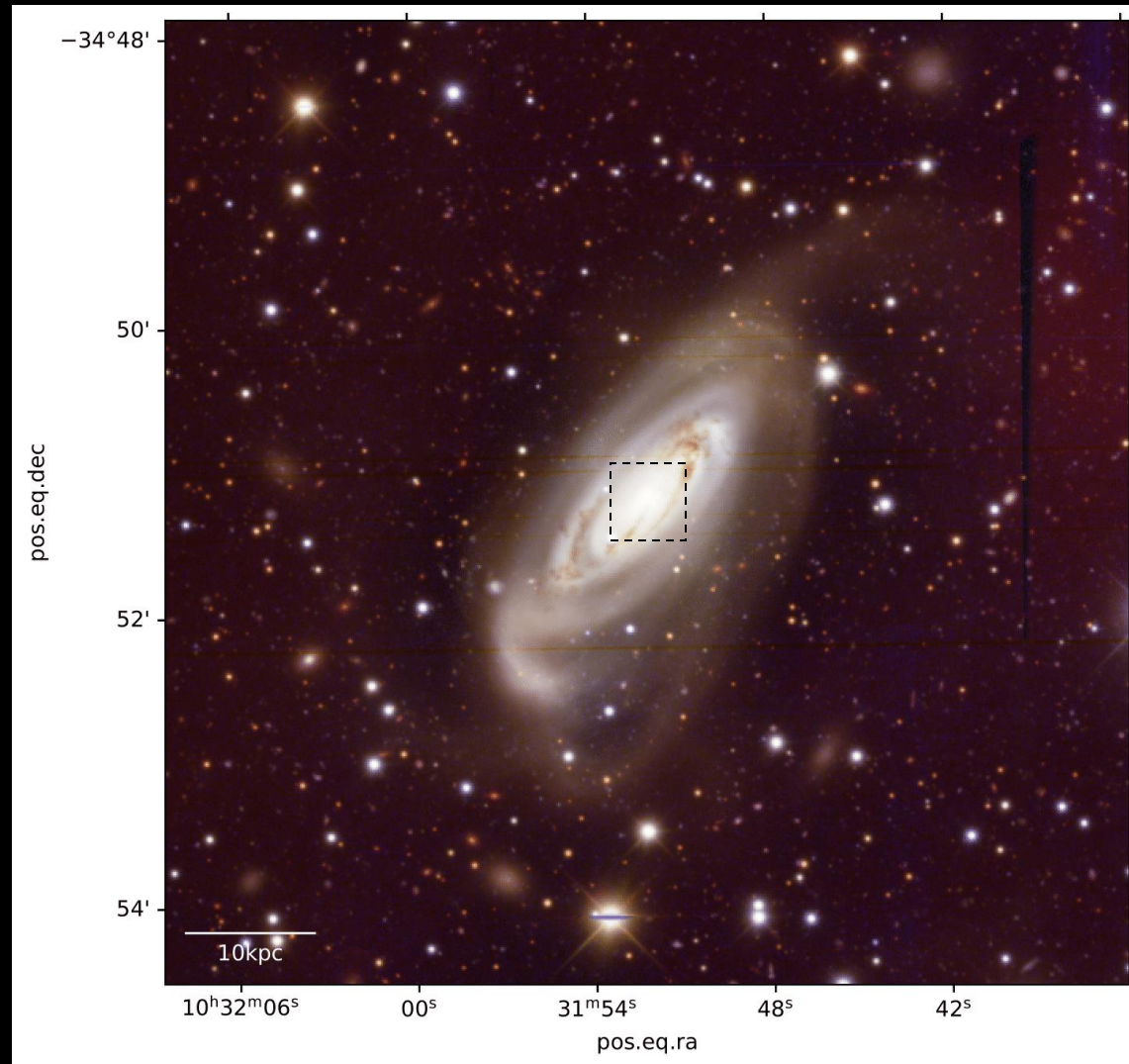


- Seyfert 2 galaxy, Sab type galaxy.
- Stellar mass $\sim 10^{9.6} M_{\odot}$. (Hess et al. 2015)

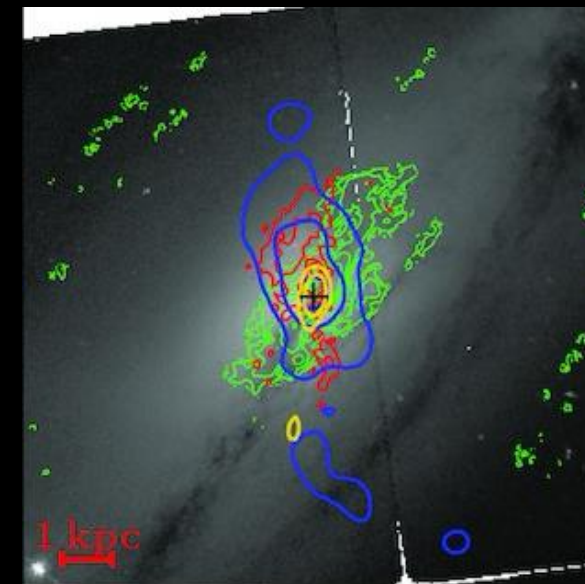
AGN (active galactic nuclei)
Unified model



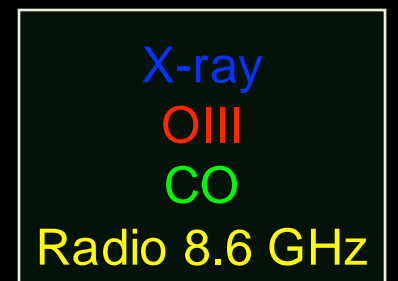
NGC3281



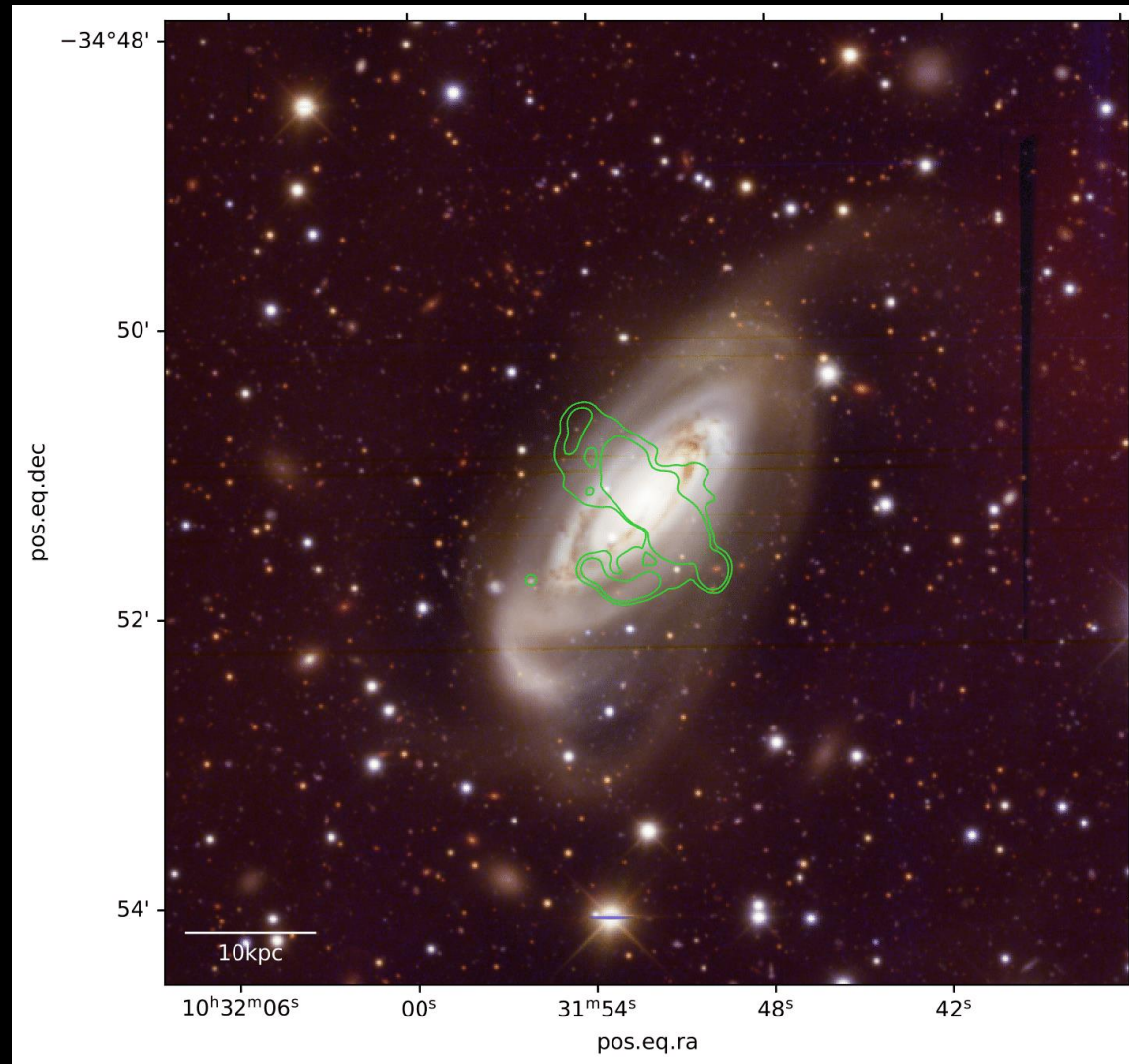
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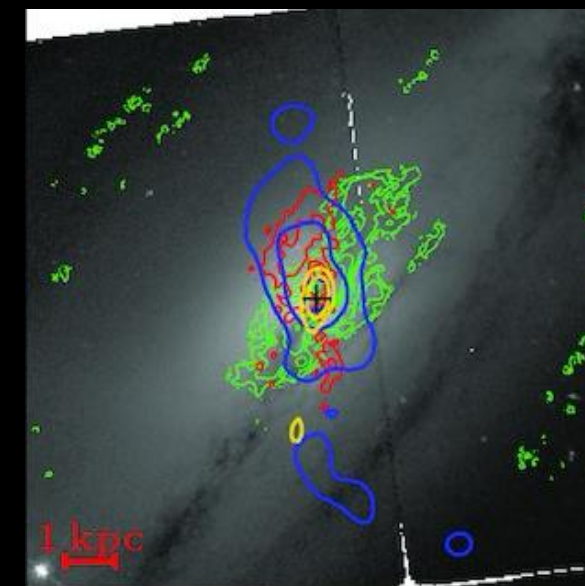
Dall'Agnol de Oliveira et al. (2023)



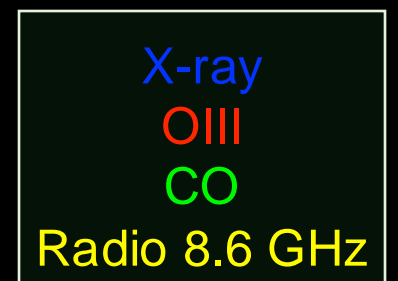
NGC3281: Radio continuum



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- Stellar mass $\sim 10^{9.6} M_{\odot}$. (Hess et al. 2015)

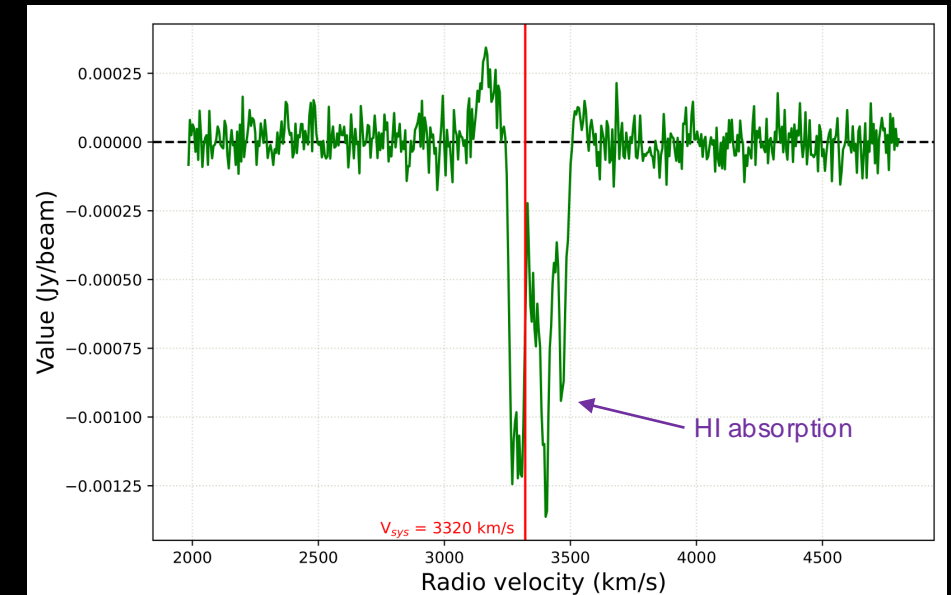
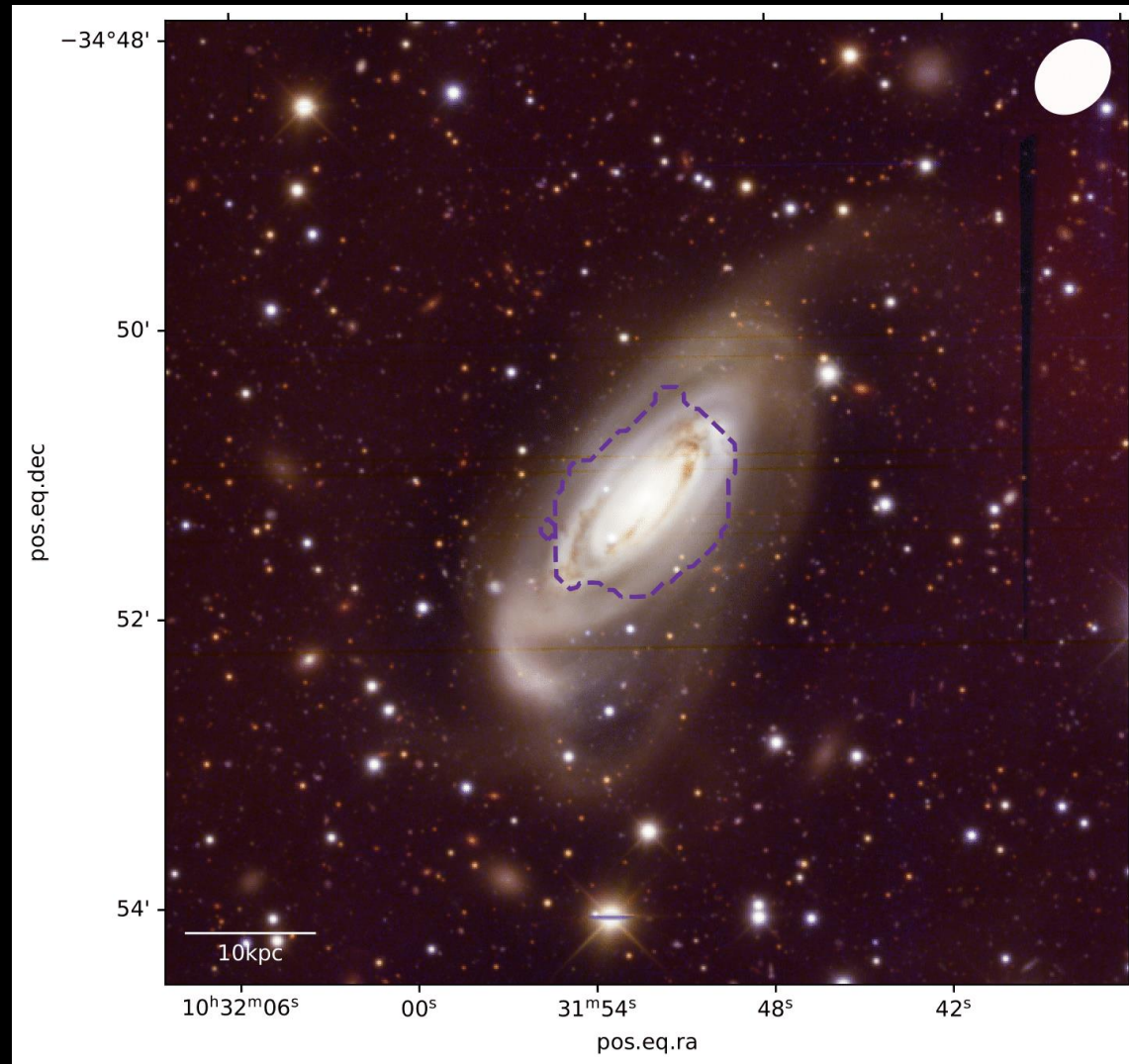


Dall'Agnol de Oliveira et al. (2023)



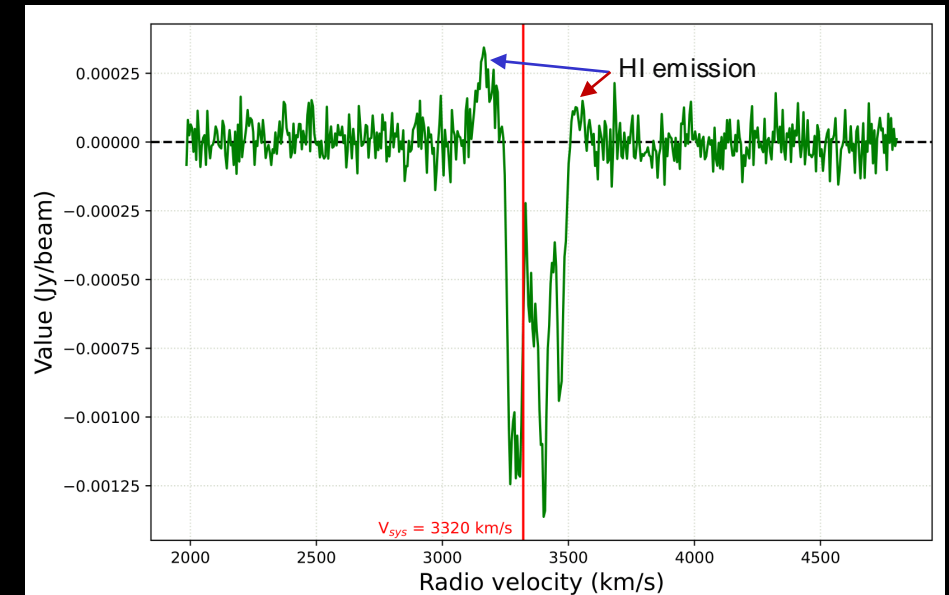
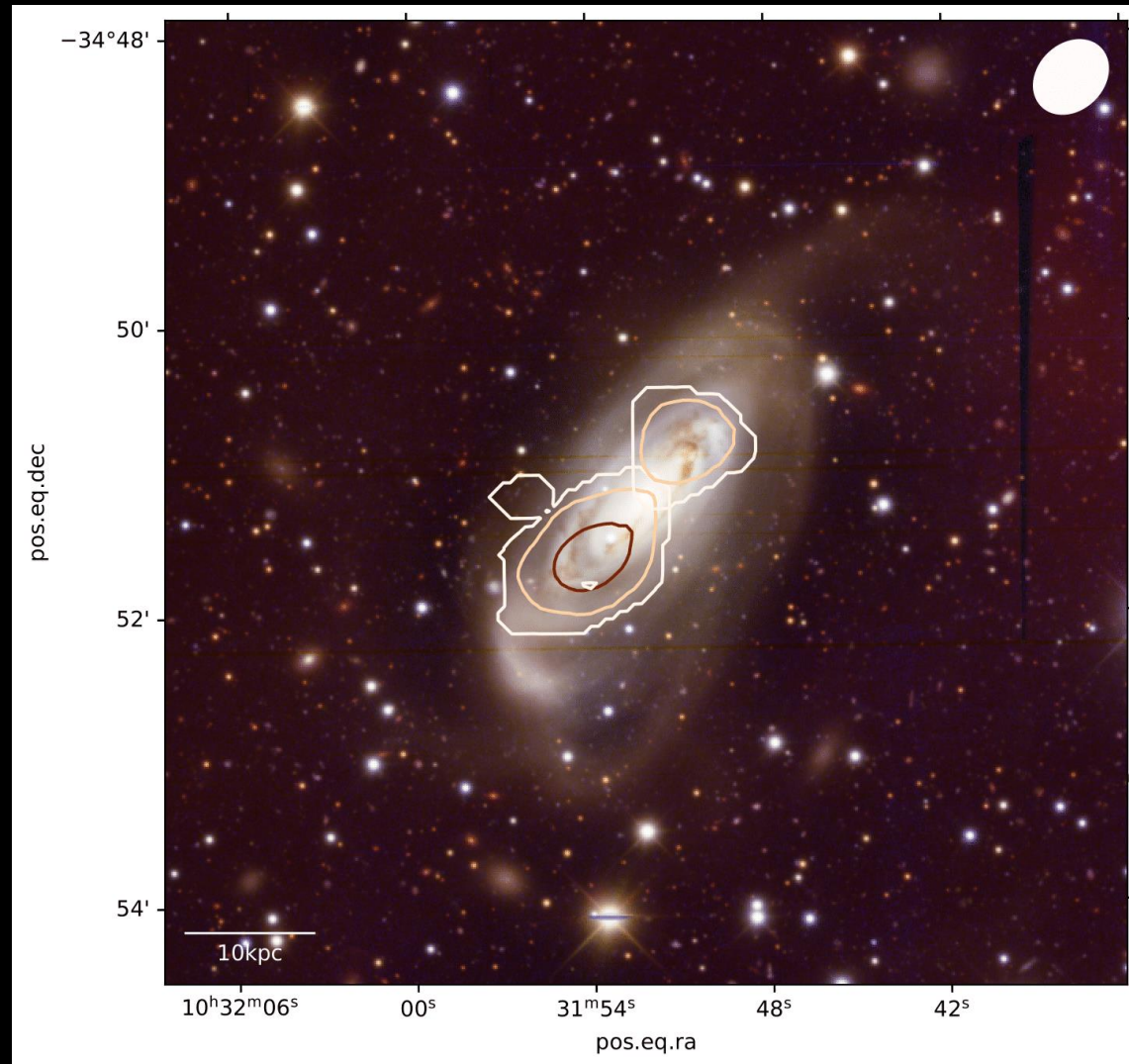
Radio continuum from Sridhar et al. (in prep.)

NGC3281: HI absorption



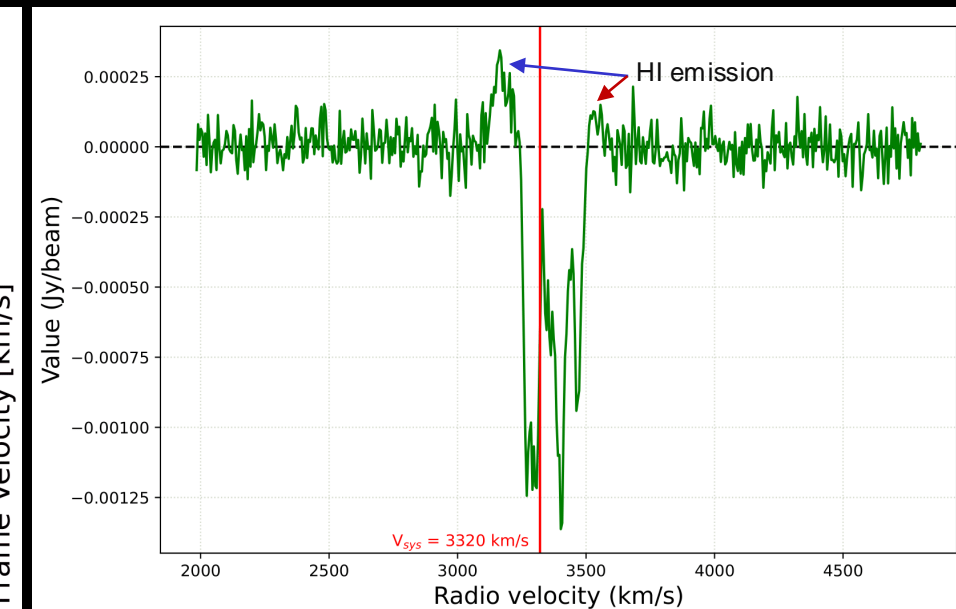
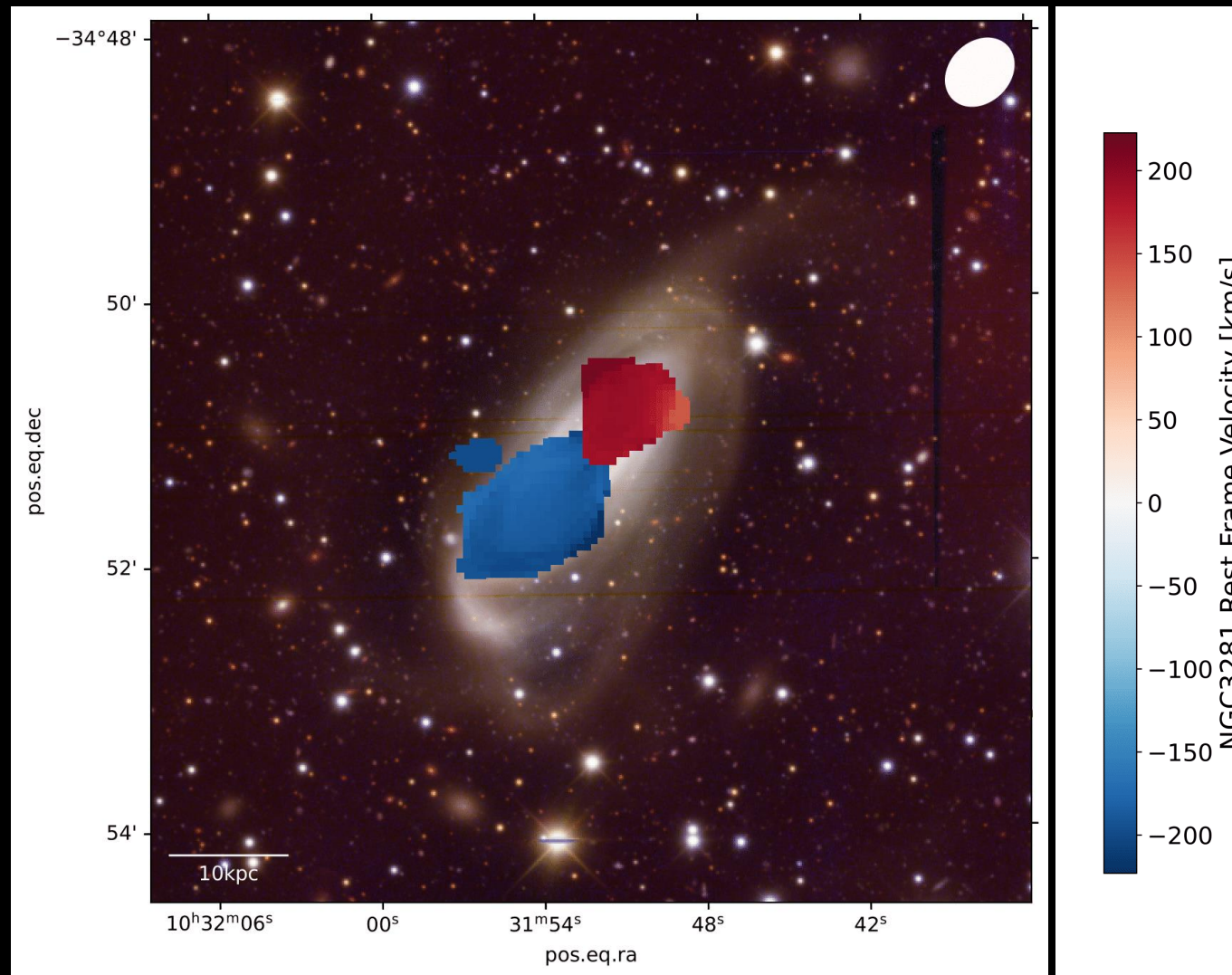
- Redshifted HI absorption suggest inflow.

NGC3281: HI emission



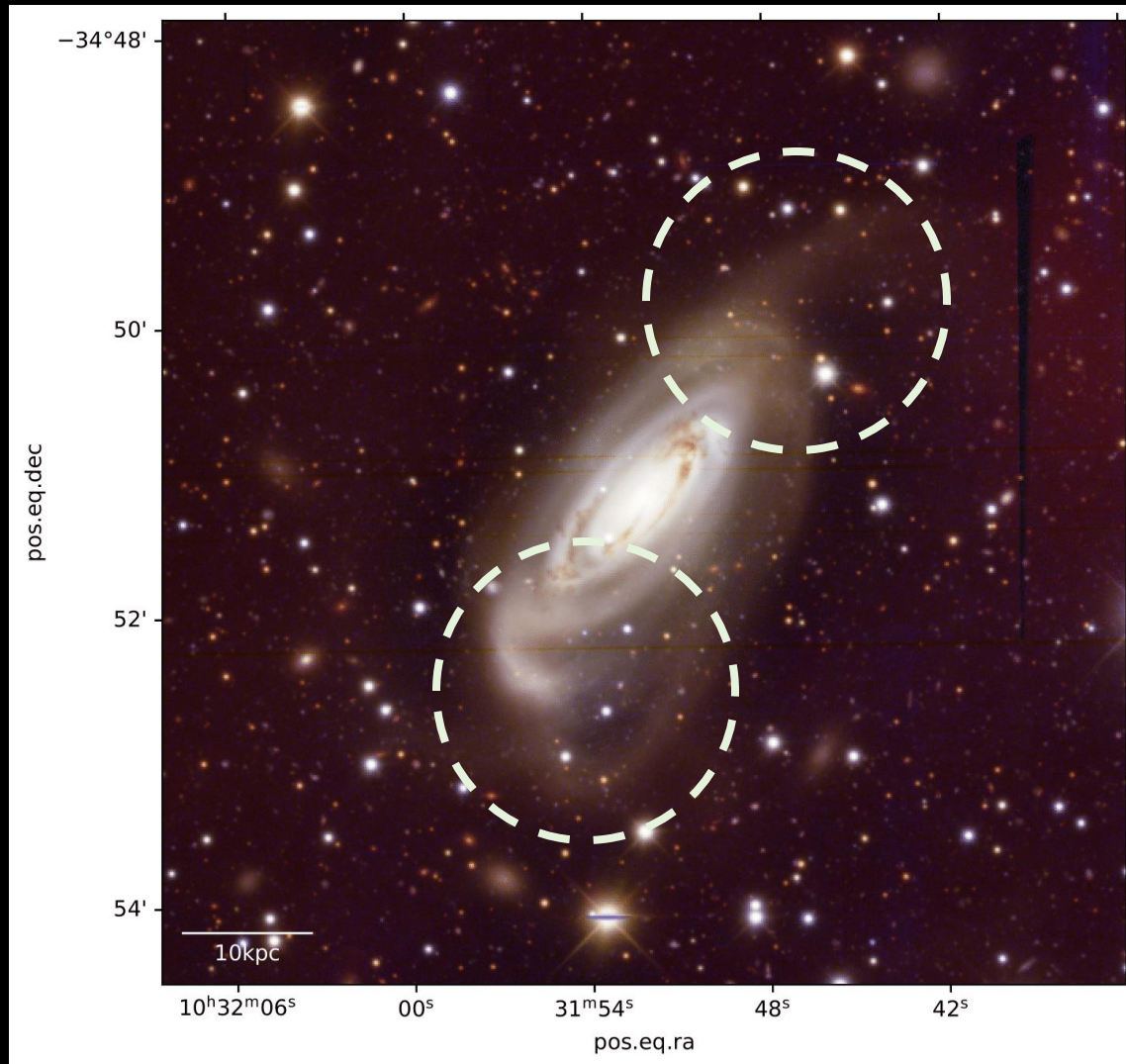
- HI emission on both sides of the galaxy.
- Most of the emission is seen on the southern side.
- Lack of extended emission past the optical disk.

NGC3281: HI emission

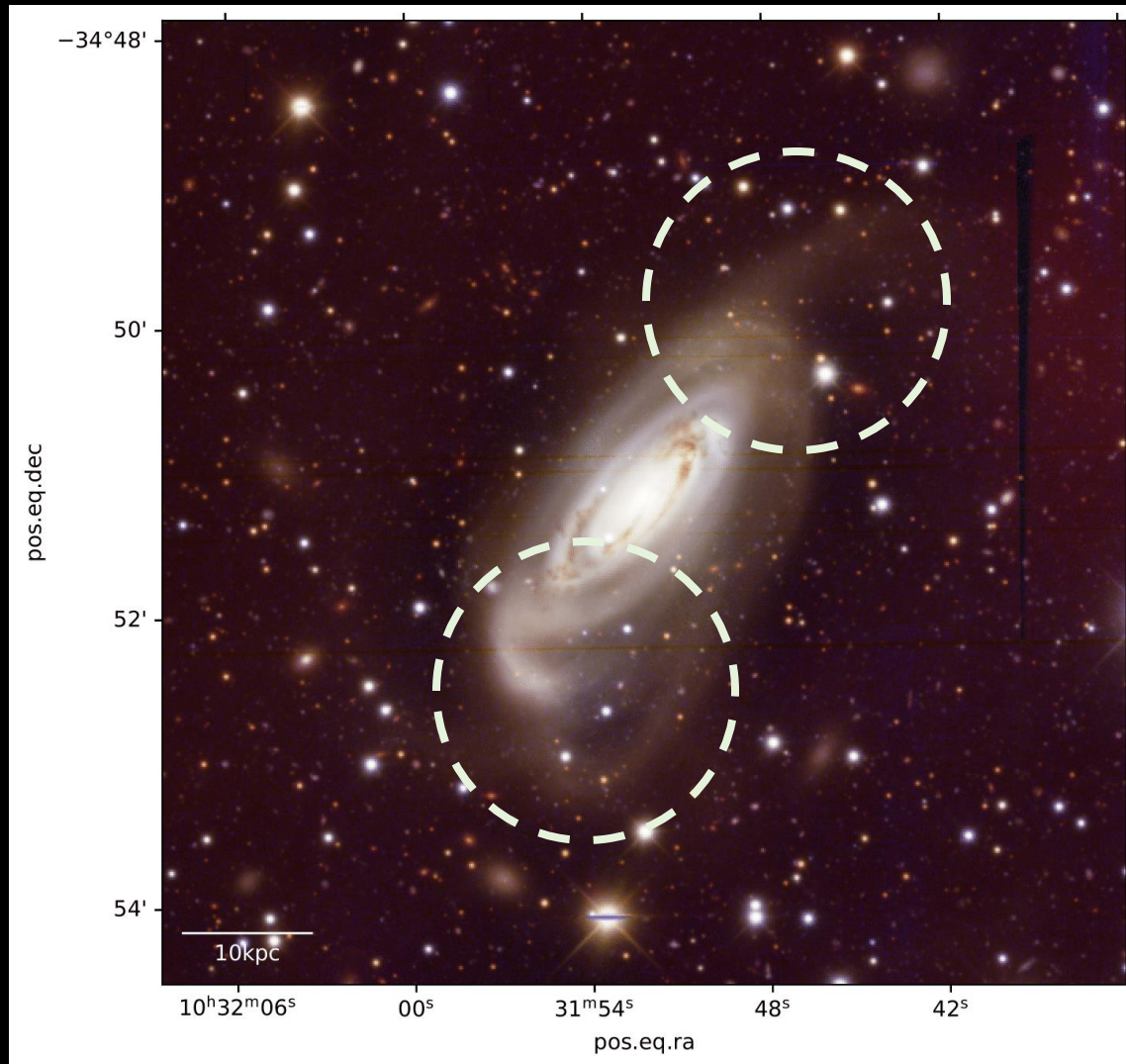


- The southern part is blueshifted and the northern part is redshifted.
- The lack of a typical gradient is due to the absorption.

NGC3281: Disturbed optical morphology

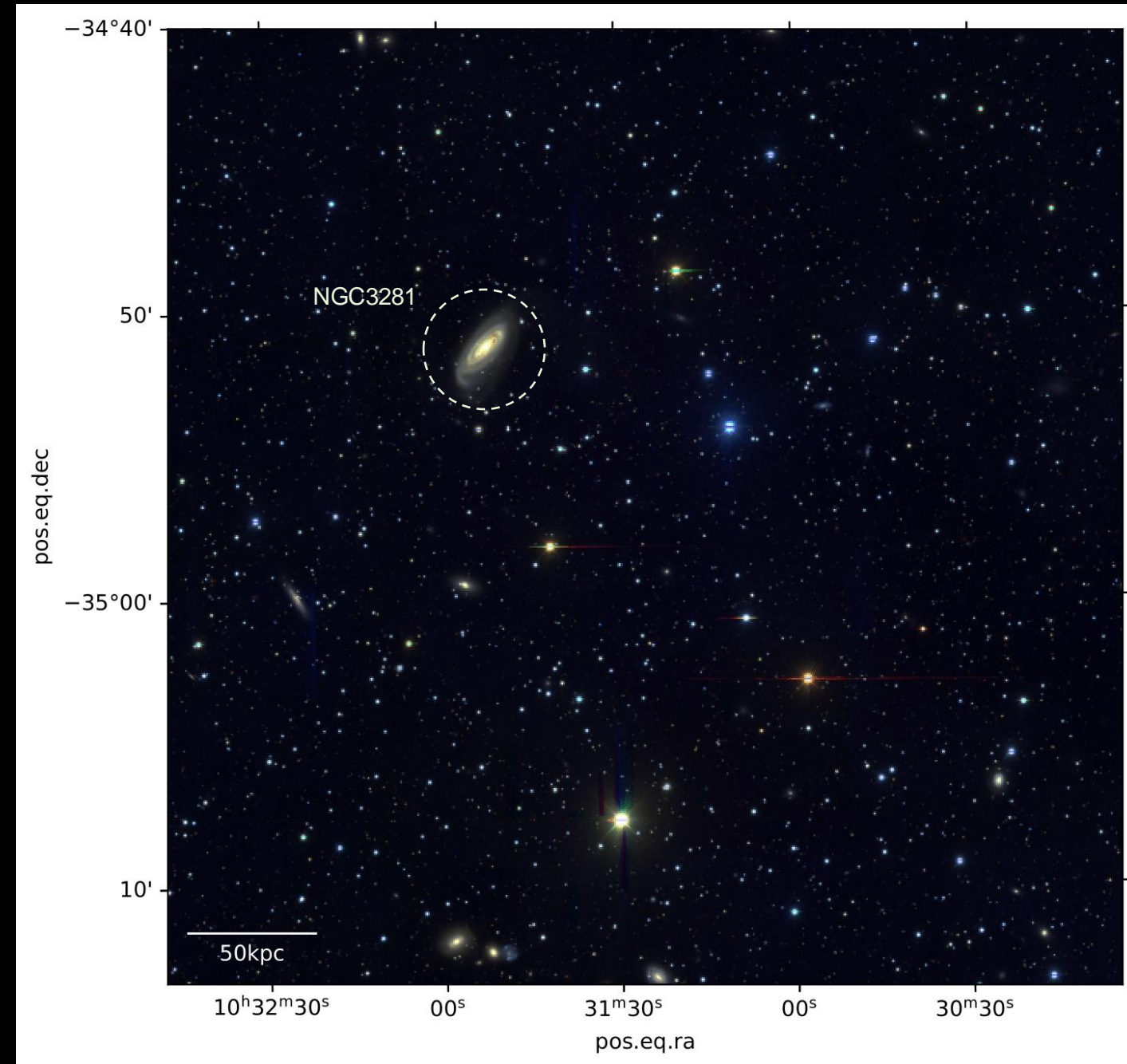


NGC3281: Disturbed optical morphology



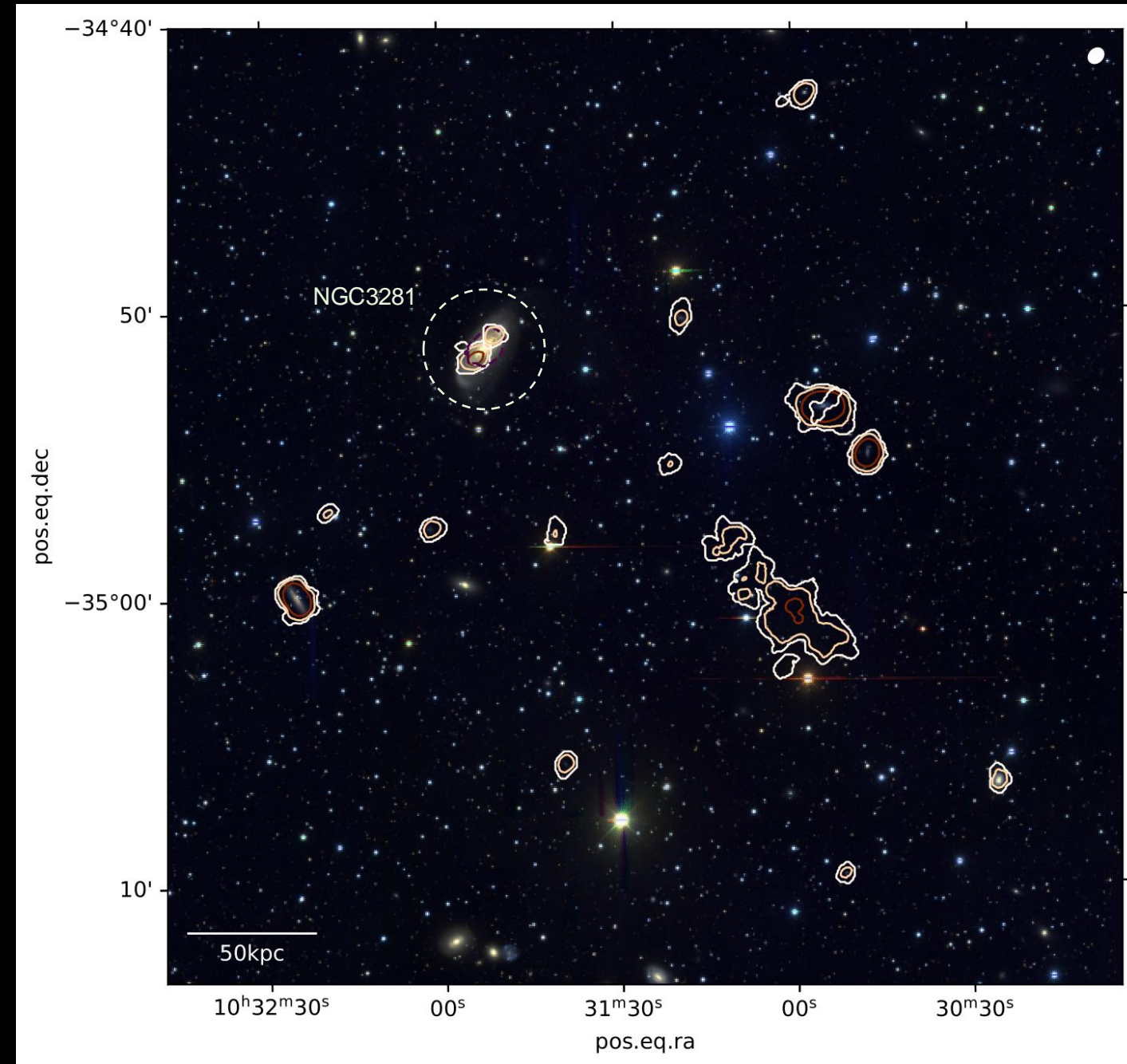
Let's look for
the culprit

Around NGC3281



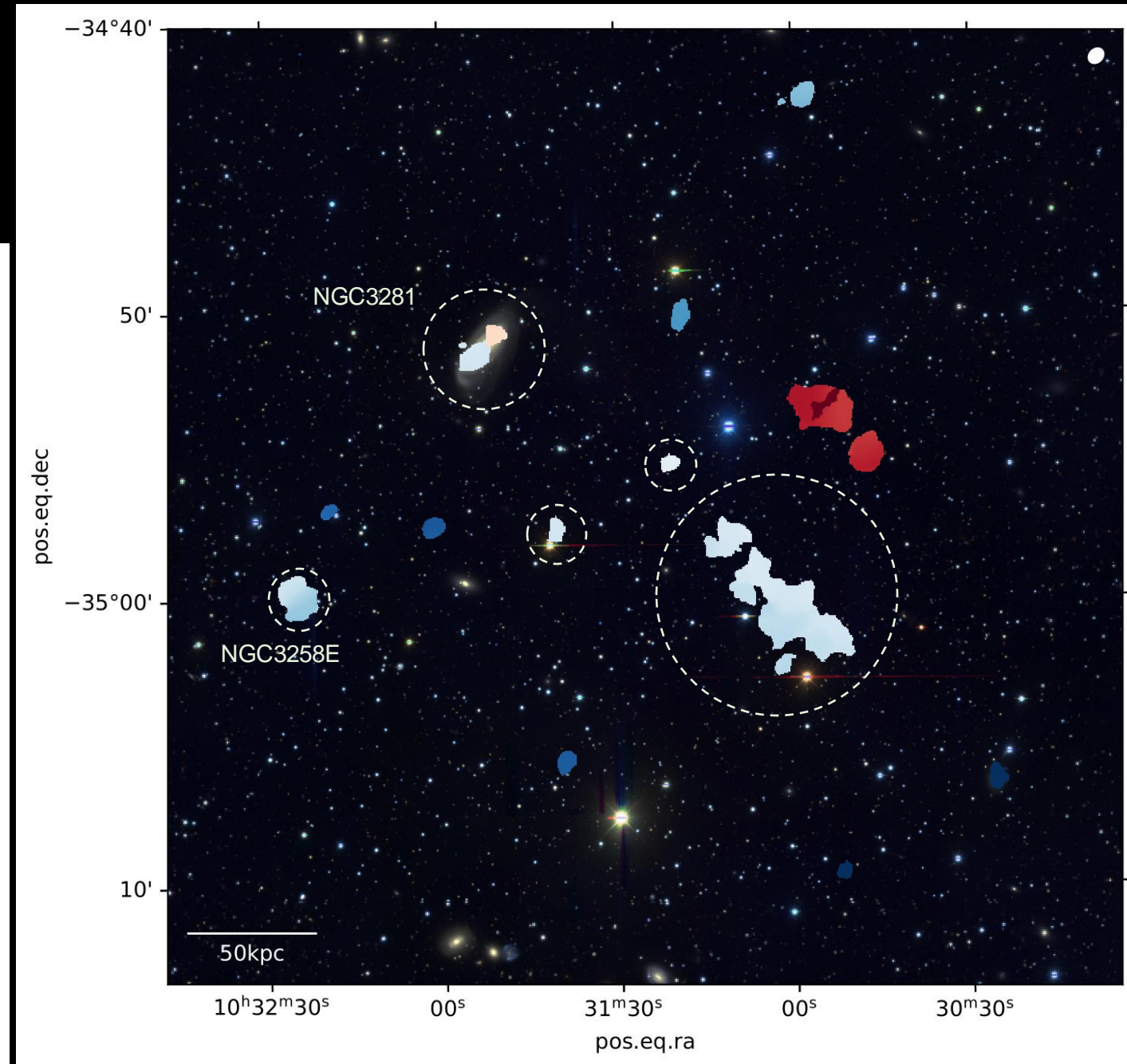
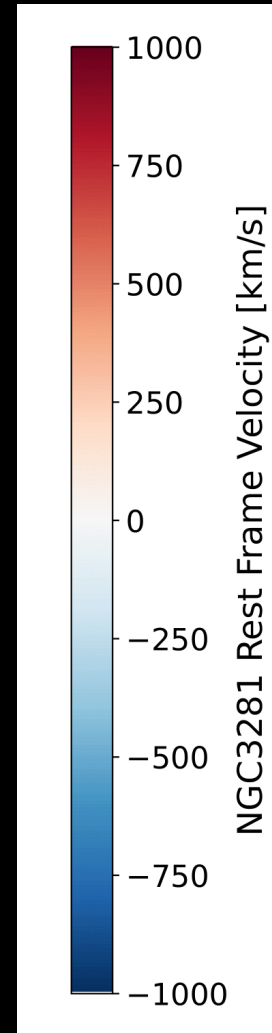
Around NGC3281

Let's turn on
the HI

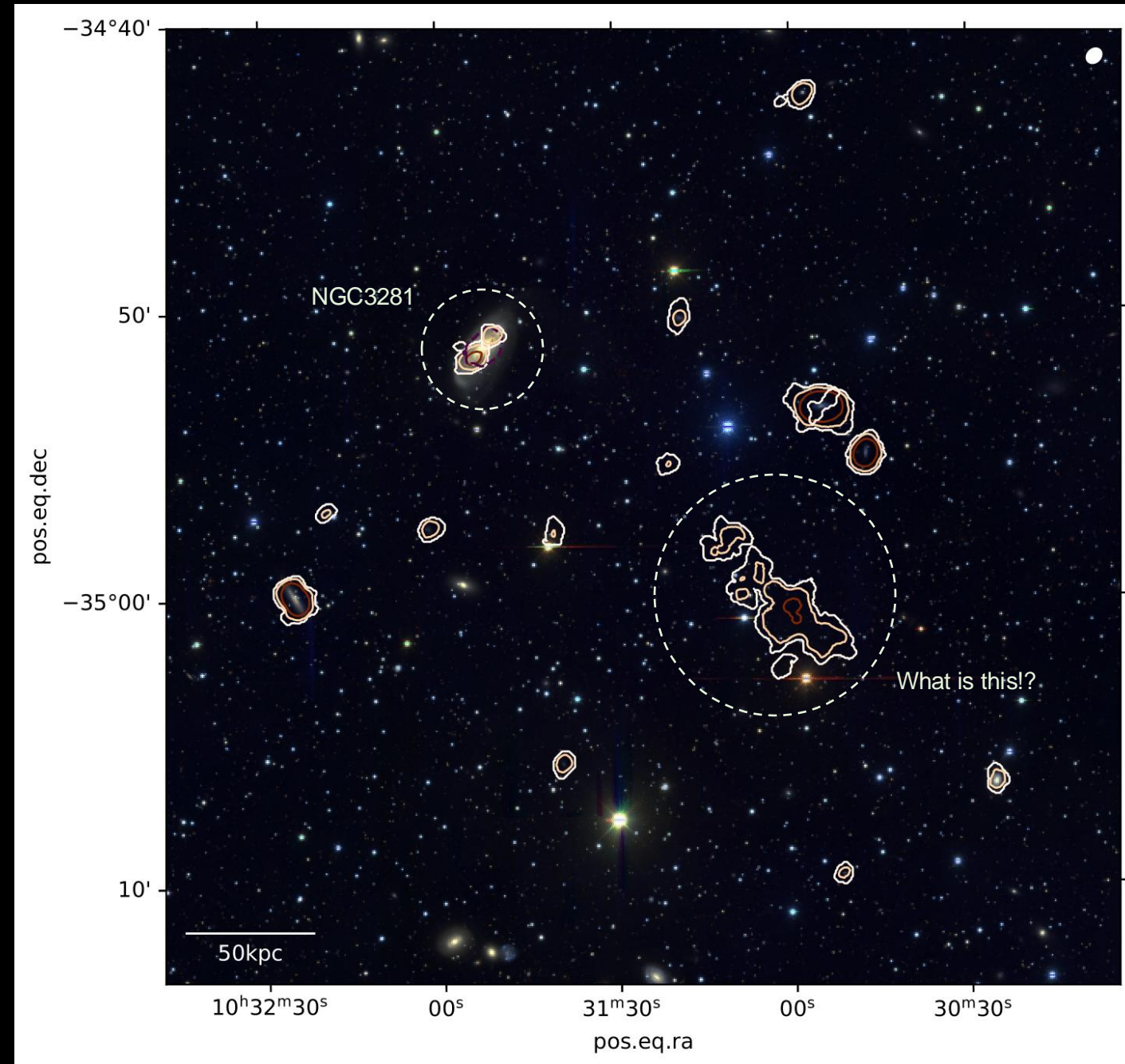


Around NGC3281: Moment 1 map

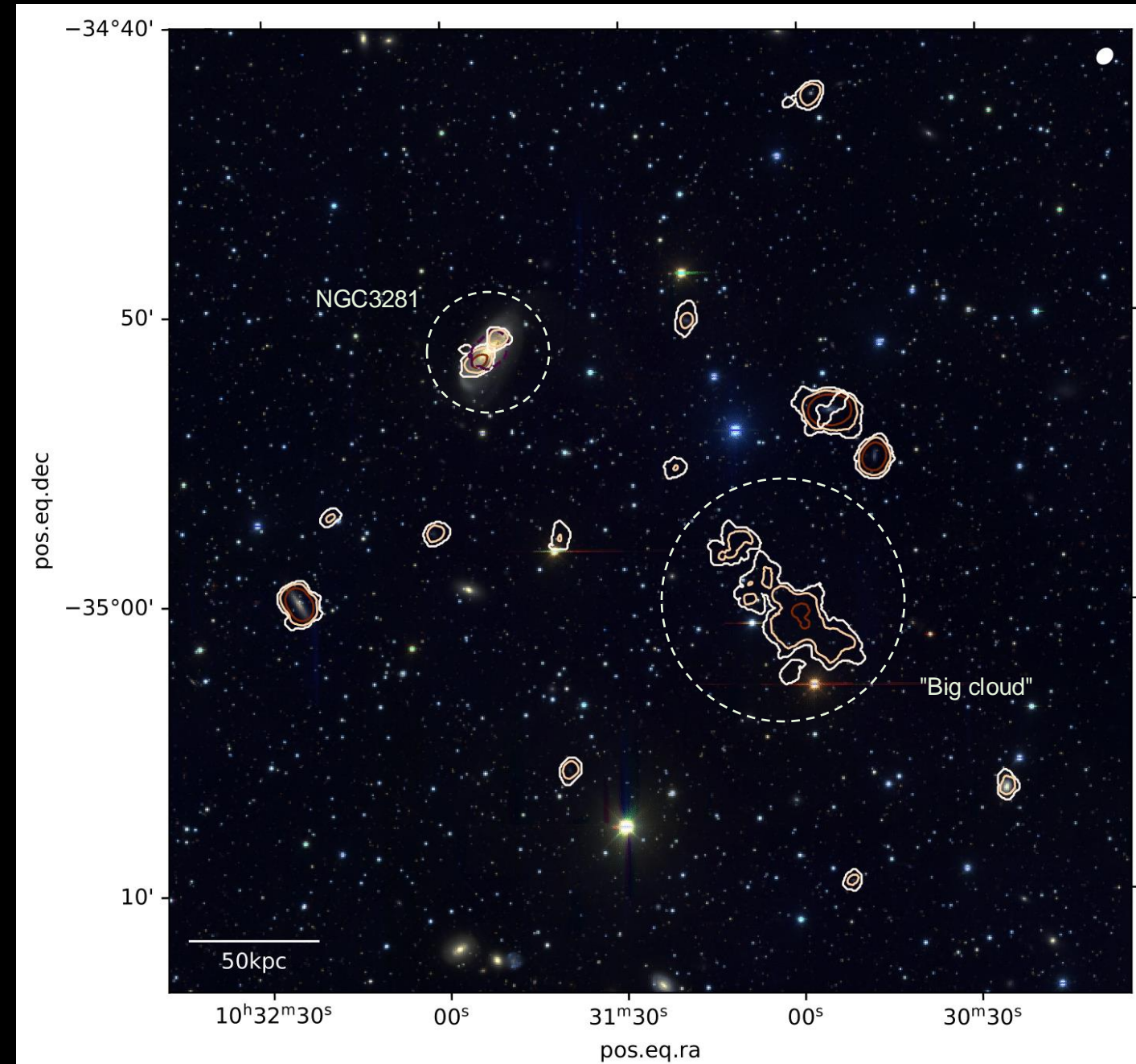
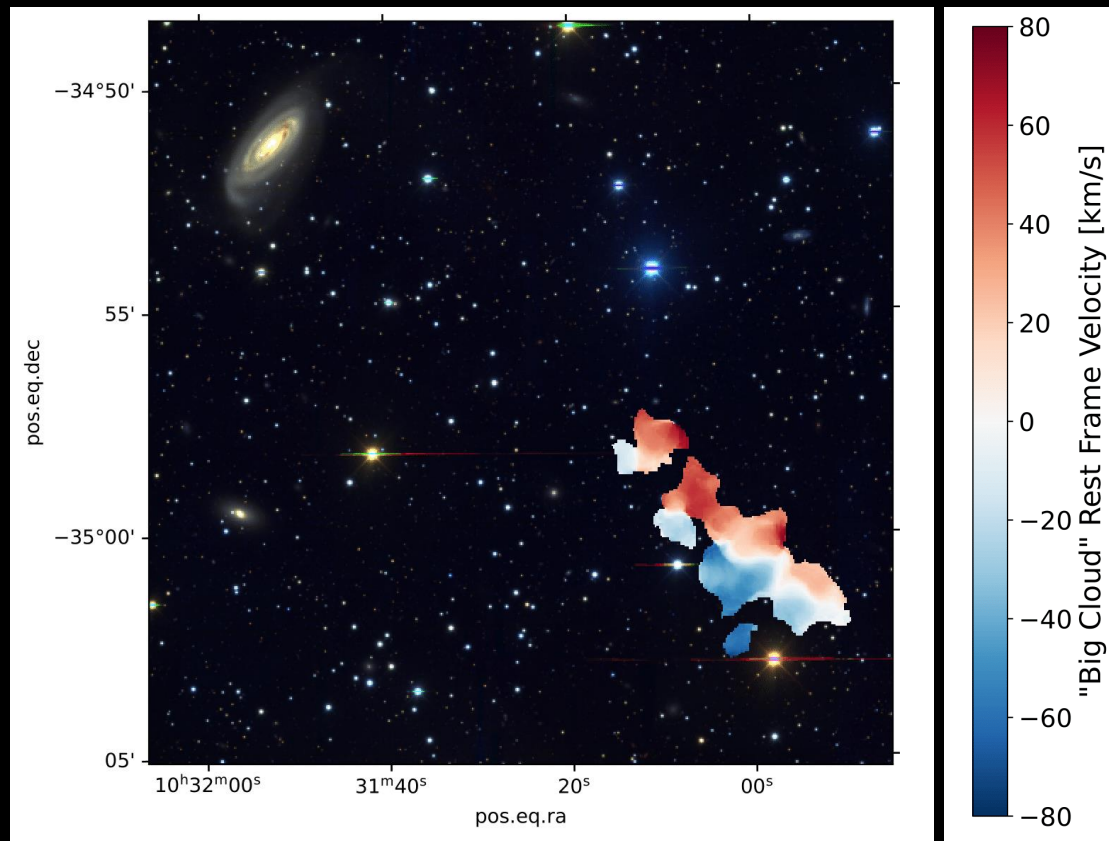
- Velocity map reveals 4 sources at similar redshift to NGC3281.



Around NGC3281: The big cloud



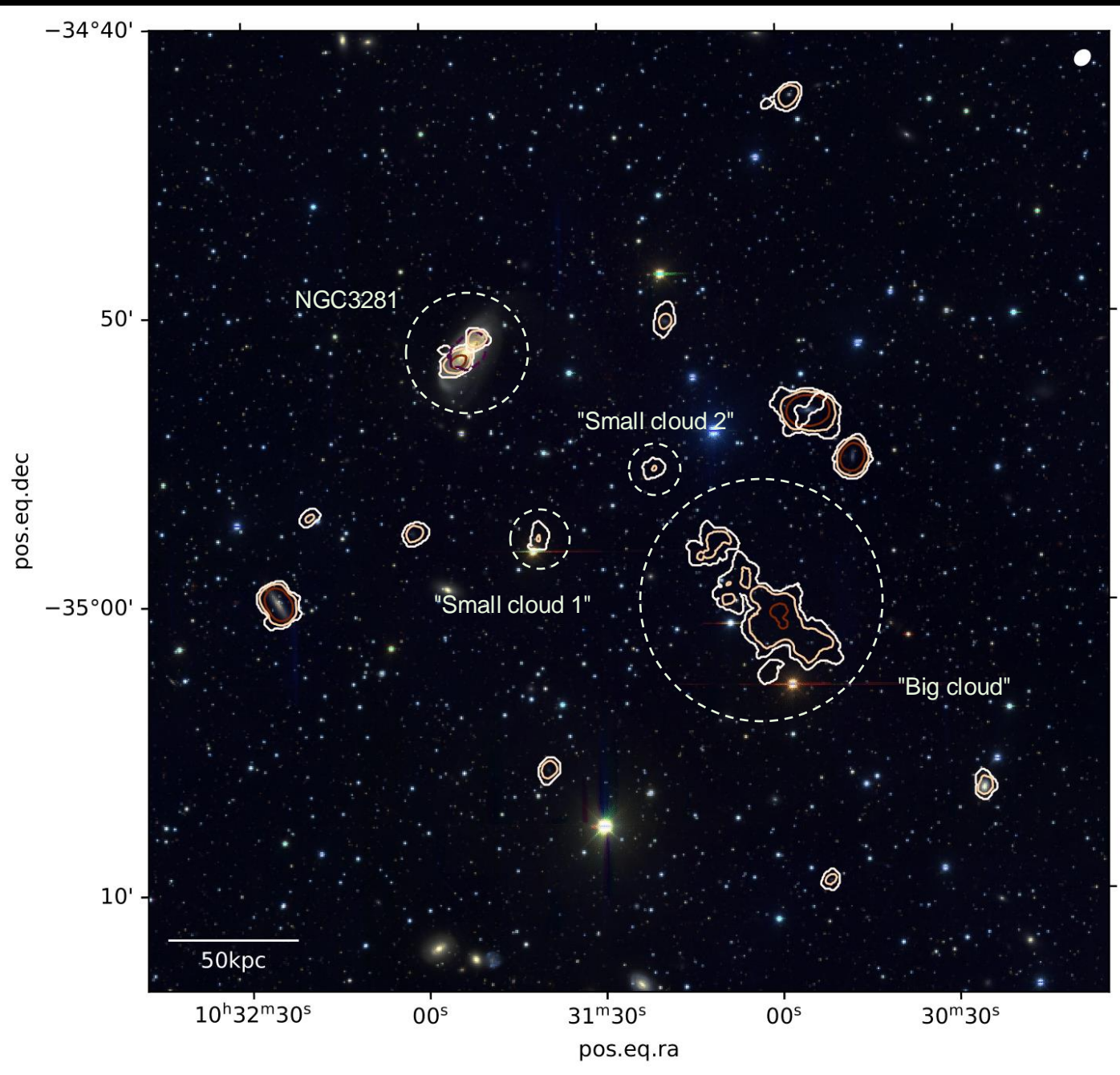
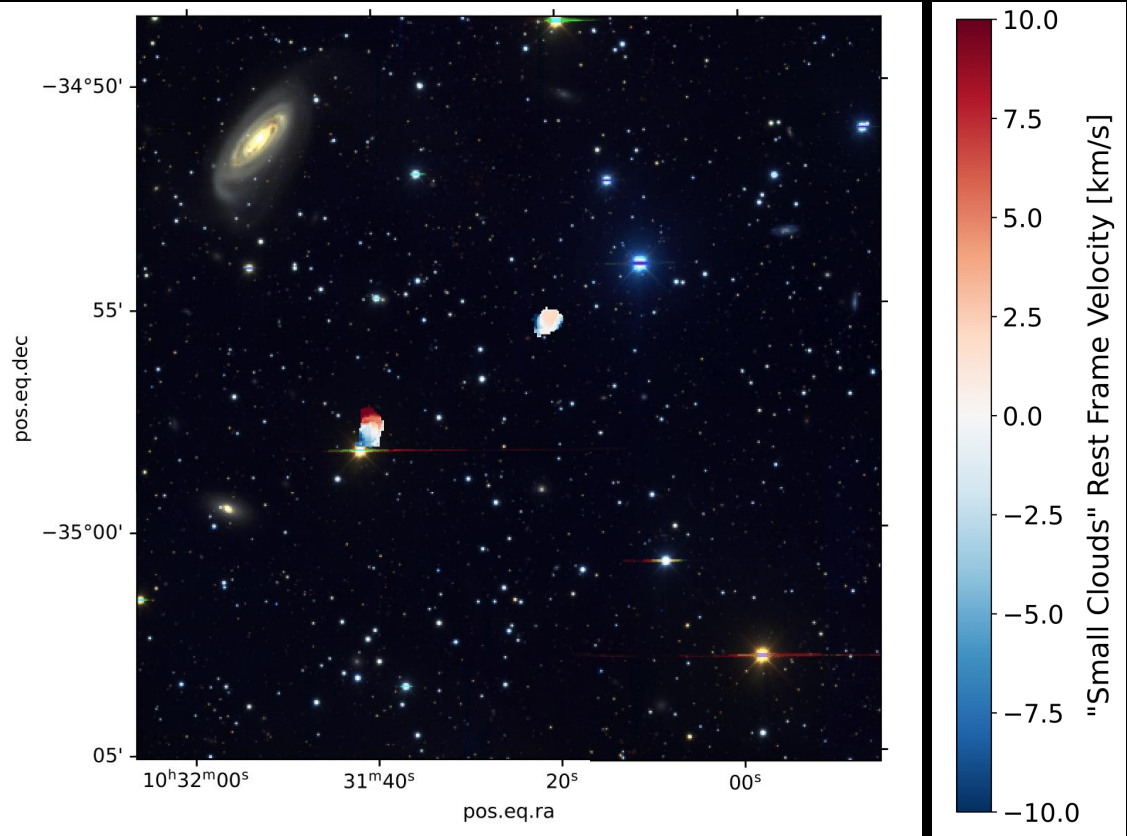
Around NGC3281: The big cloud



- HI mass of $\sim 10^{8.6} M_{\odot}$.
- Rotates like a galaxy.

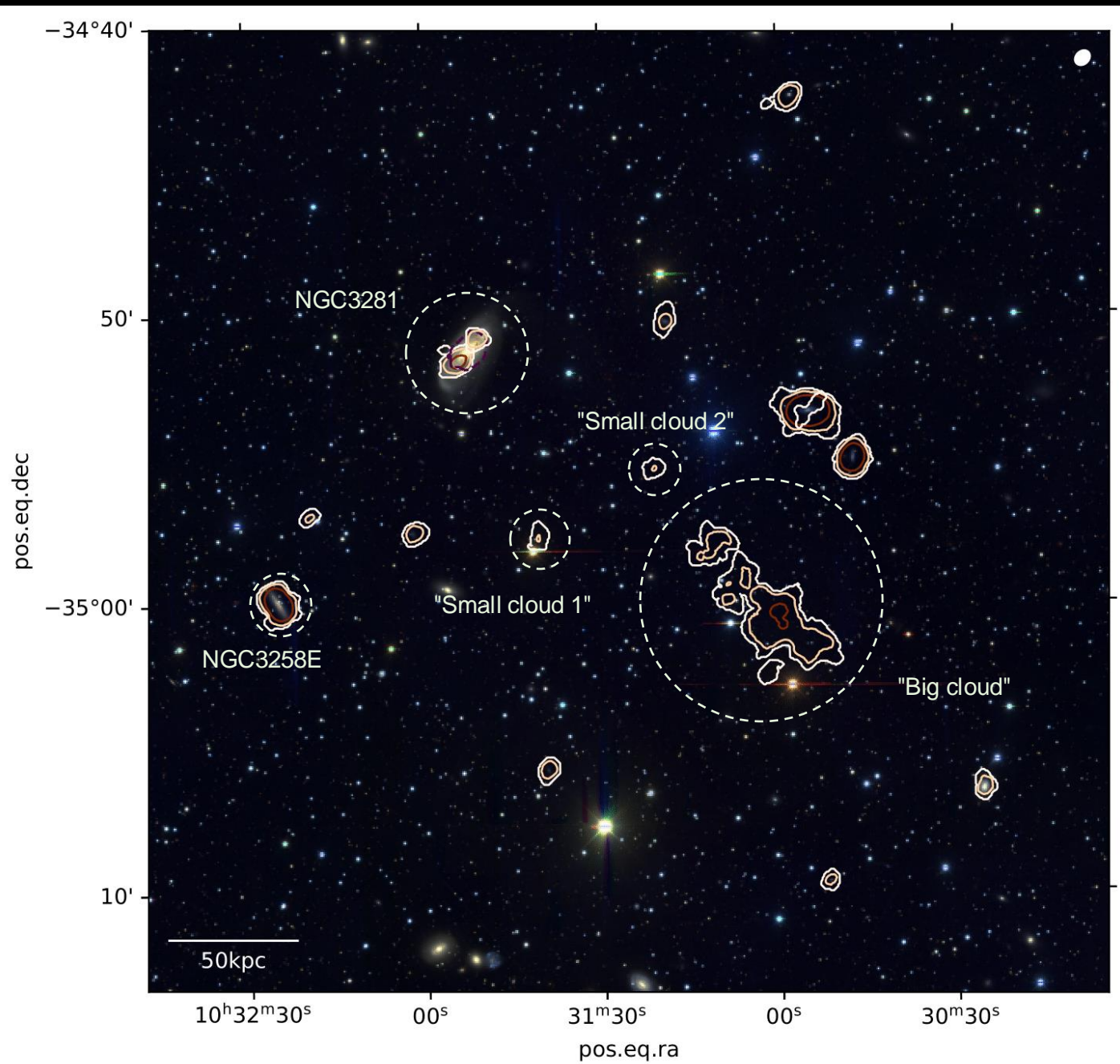
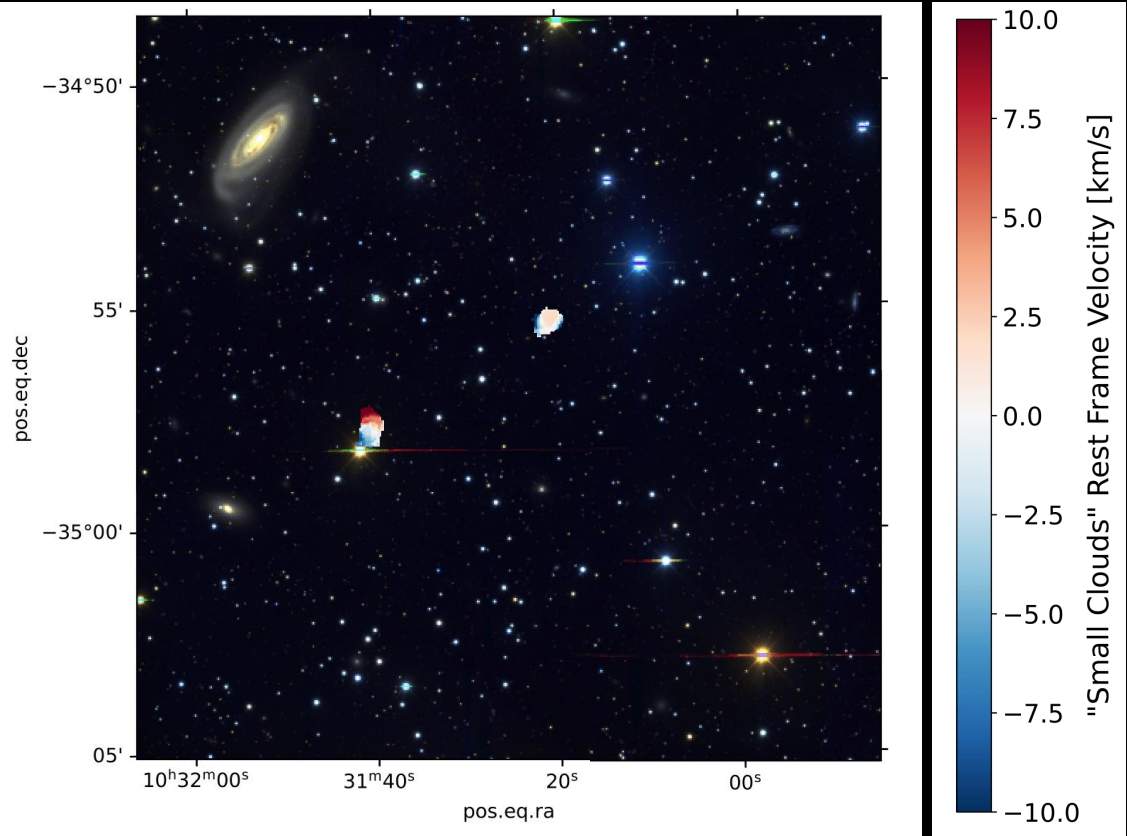
Contact email: froemel@chalmers.se

Around NGC3281: The small clouds



Contact email: froemel@chalmers.se

Around NGC3281: Let's speculate...



Summary

- Our data provides the opportunity to study in great detail galaxy evolution in the Antlia cluster.
- Preliminary study of NGC3281:
 - Evidence suggest NGC3281 underwent a merger event, which might have activated the AGN at the galaxy's center.
 - Radio clouds without optical counterparts are observed at similar redshifts to NGC3281. Connection with NGC3281 is plausible, but unclear at the moment.
- Future work (a lot!):
 - Full comprehensive multi-wavelength study of NGC3281.
 - Have fun exploring the rest of the cluster.
 - Explore the connection between Antlia and Hydra.