A large HI ring-like structure around a massive quiescent galaxy

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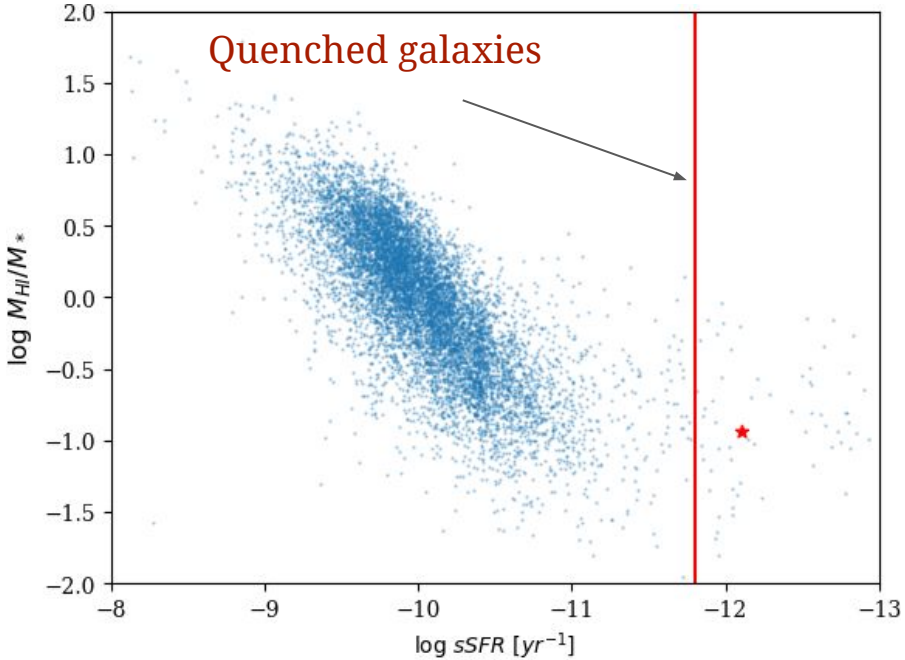
Introduction

- Galaxies in the local Universe are known to follow a bi-modal distribution in their star formation properties.
- With a mode of galaxies with active star formation, having higher specific star formation rate (sSFR), and the other mode of quenched galaxies governed by very low specific star formation rate.
- These quenched galaxies, which are mostly early-type galaxies, interestingly are known to have HI gas in them as shown by the HI study of ATLAS 3D galaxies. (Serra et al. 2012)

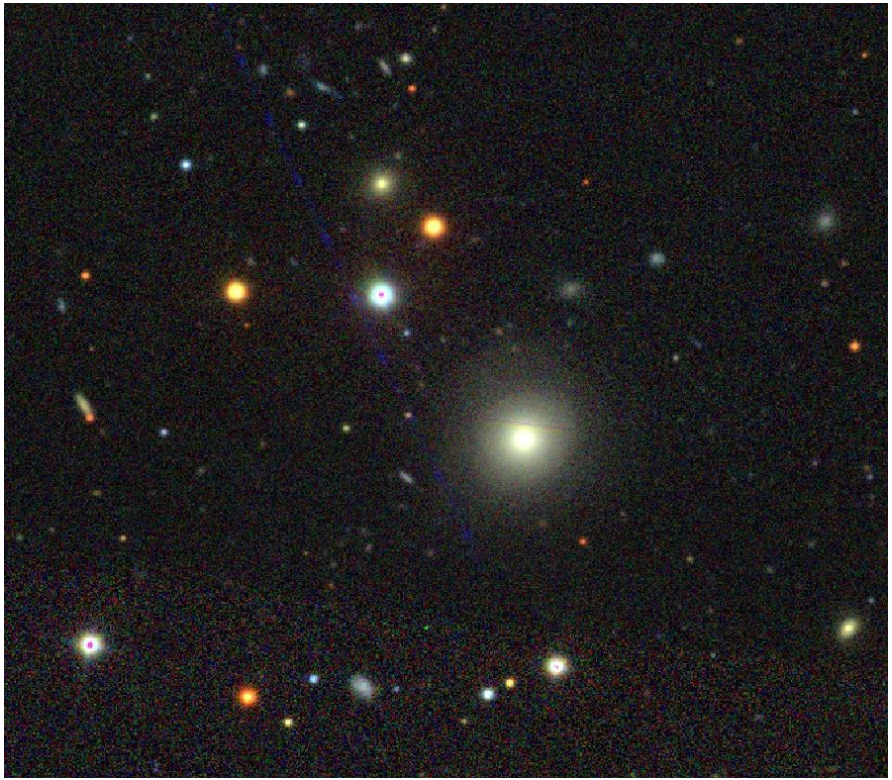
- However, the HI gas fraction of galaxies decline as the sSFR goes down. (Catinella et al. 2010)

Motivation: HI in Quenched Galaxies



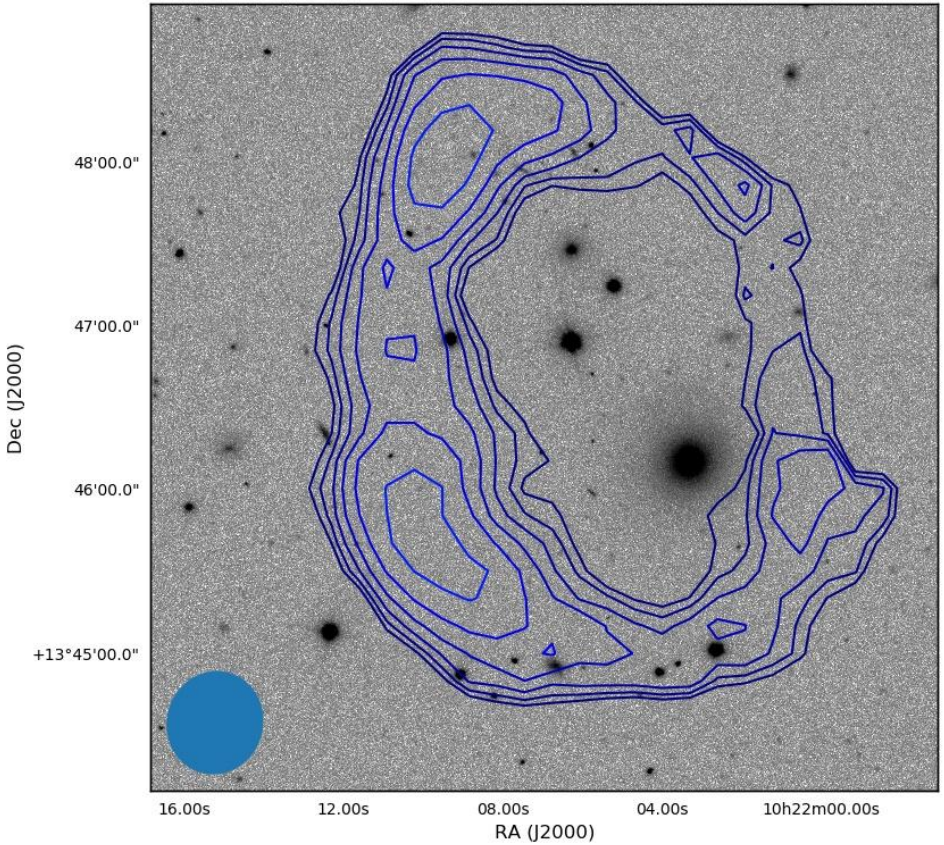
- ALFALFA + GALEX-SDSS-WISE LEGACY CATALOG (Salim et al. 2016).
- Galaxy is quenched, has single dish HI gas detection, and z < 0.025.
- To study the origin of gas in quenched galaxies by studying the resolved HI morphology and kinematics using the Giant Metrewave Radio Telescope (GMRT).

Target Source: AGC 203001



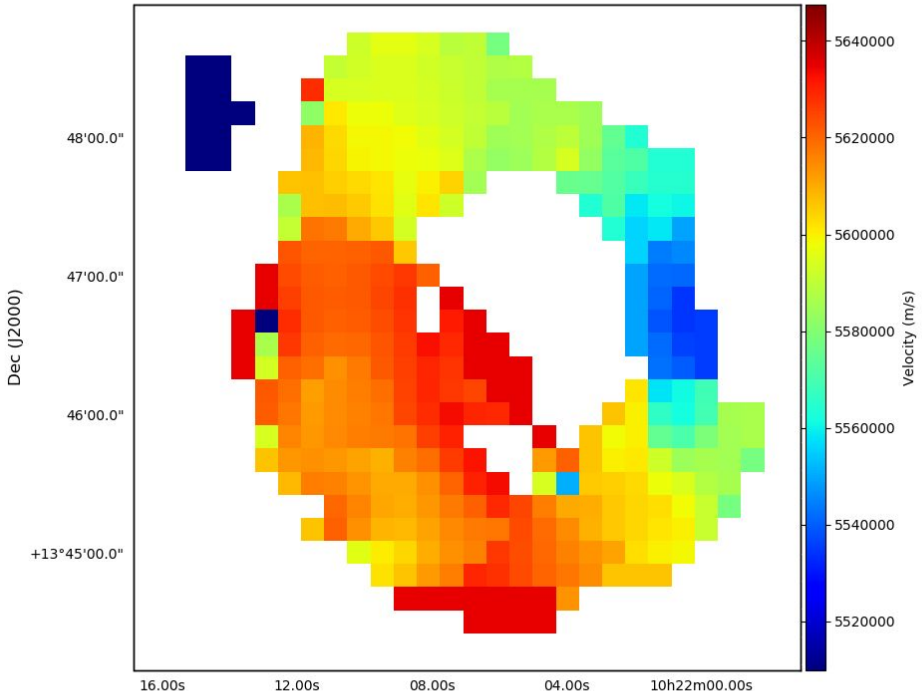
- S0 type galaxy.
- $M_* = 1.5 \times 10^{10}\ M_\odot$
- SFR = 0.011 $M_\odot$/yr
- z = 0.018
- This galaxy is in a small group of four galaxies.

HI Moment 0 Map

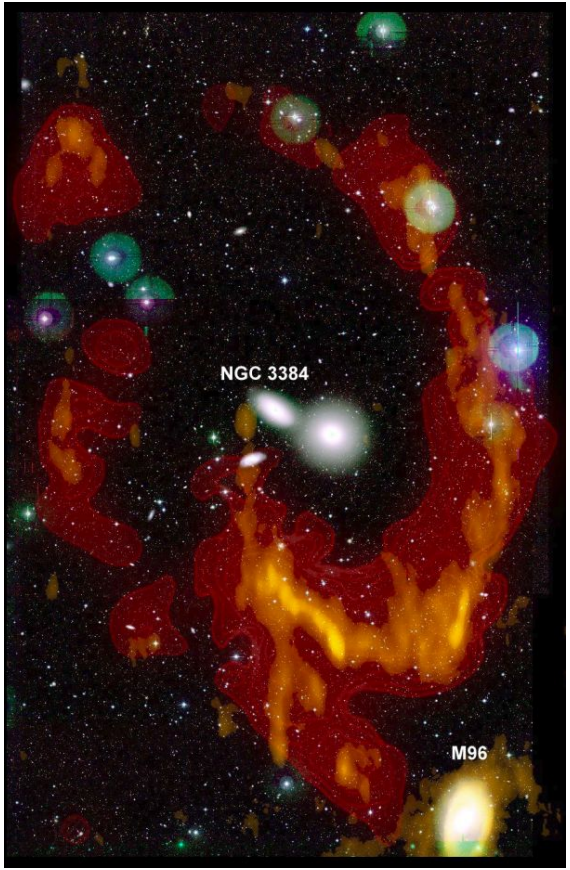


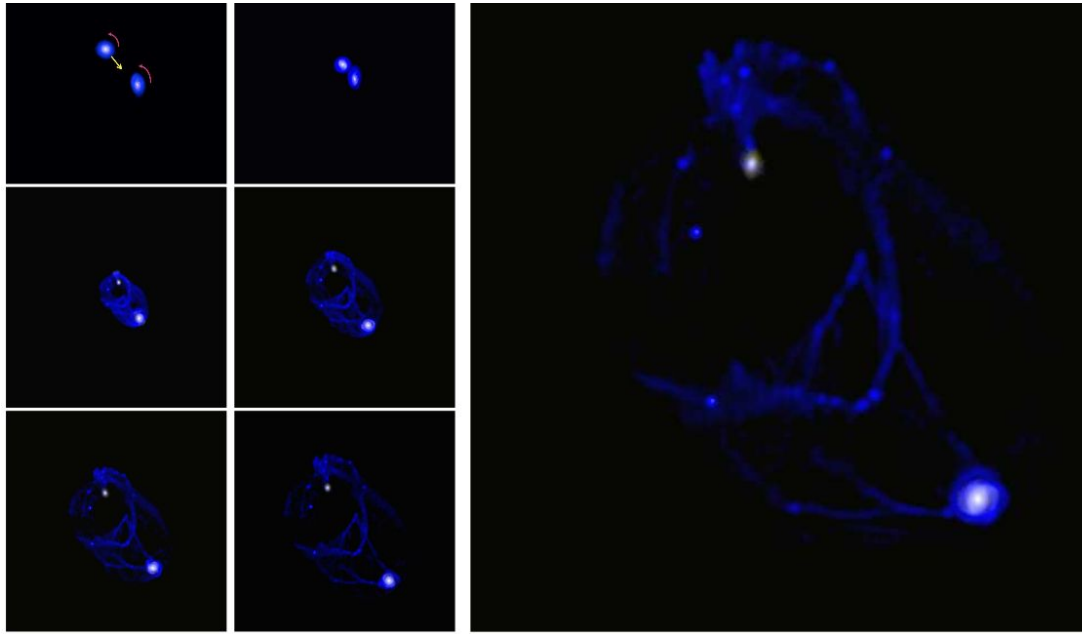
- The background is the optical r-band image from the SDSS.
- The HI contours start from 1.6×10^{19} cm^{-2}, and increase in steps of $\sqrt{2}$.
- The HI mass is ~2×10^{9} $M_{\odot}$.
- The ring is offset from the host galaxy. It has a diameter of ~90 kpc.
- Most, interestingly, it doesn't have any bright optical counterpart.

HI Moment 1 Map



Leo ring galaxy





Michel-Dansac et al. 2010

Summary

- We have discovered a large HI ring around a quenched galaxy.
- This ring is offset from the host galaxy, but it regularly rotating around it.
- There is no bright optical counterpart to this ring. A deeper optical image can reveal more.
- What forms this ring? Galaxy-galaxy interactions? Tidal stripping? Central Starburst making a hole in the centre?

Acknowledgments

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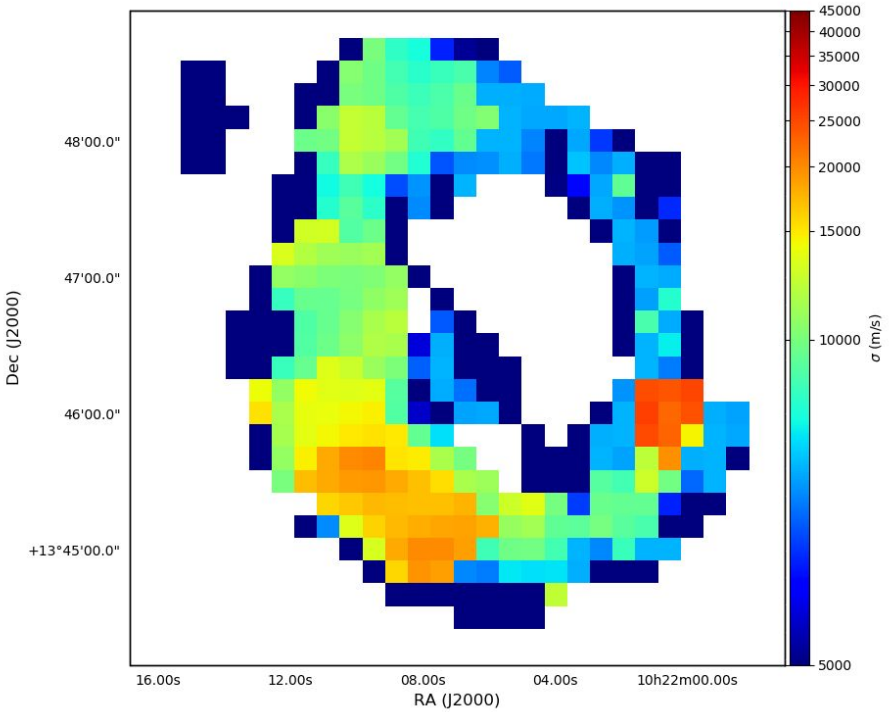
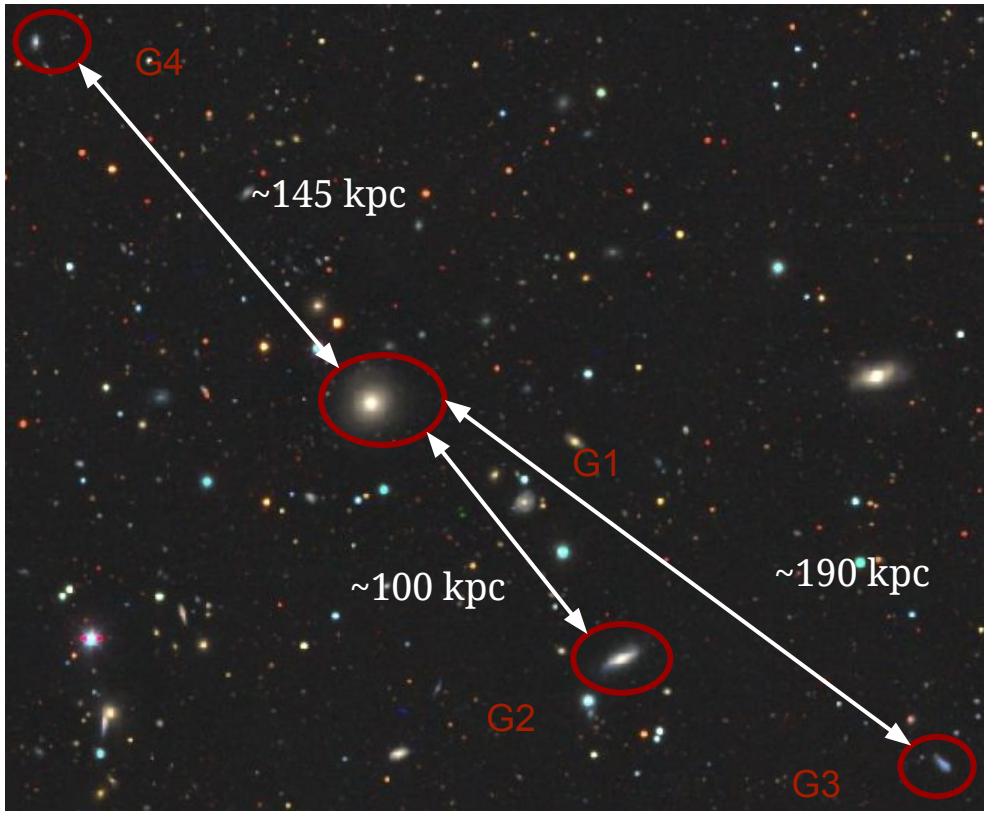
HI Moment 2 Map



Target Source: AGC 203001



- G2: $M_* = 5 \times 10^9\ M_\odot$
- SFR = 0.16 $M_\odot$/yr
- z = 0.0184

HI Moment 0 Map