Studying extra-planar gas in the halos of MaNGA galaxies

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MaNGA

SDSS
MW Gaseous Halo

M.E. Putman, J.E.G. Peek, & M.R. Joung, 2012
Gaseous Halos

DIG IN EDGE-ON SPIRALS

NGC 891

NGC 4631

UGC 9242

NGC 4244

C. Hoopes & R. Walterbos, 1999
MaNGA-SDSS IV

- Mapping Nearby Galaxies at APO
- 6 year survey part of SDSS IV
- Observing ~10 000 galaxies at z~0.03
- IFU with varying bundle sizes
- 360-1000 nm with R=2000
- Bundy, et al 2014

A MaNGA target galaxy, 500 Myr away
Stacked spectra

![Graph showing stacked spectra with data, fit, 1σ err, and 3σ err lines.](image)

![Graph showing S/N versus number of fibers stacked.](image)

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Emission Line Profiles
Emission Line Profiles

![Graph showing emission line profiles](image-url)
Emission Line Ratios

![Graph showing emission line ratios as a function of z/b_e. The graph includes lines for different ratios such as [NII]/Hα, [SII]/Hα, [OII]/Hα, [OIII]/[OII], and [SII]/[NII].]
Zoom in on Emission Lines

Hα and [NII] region

L (10^36 erg/s/Ang/arcsec^2)

6540 6560 6580 6600
Wavelength (Ang)

[SII] region

6700 6710 6720 6730 6740 6750
Wavelength (Ang)
BPT Diagram
Emission Line Profiles out to Large Re!

![Graph showing emission line profiles](image-url)
Split by sSFR

![Graphs showing the relationship between Log([NII]/Hβ) and Log([SII]/Hα) for different regions of a galaxy, with markers for center, disk, outer disk, and halo, and split by sSFR.]
Split by Concentration Index
Split by Stellar Mass
Subsamples: Emission Line Comparisons
Subsamples: Emission Line Comparisons

![Graph showing emission line comparisons for different subsamples.](Image)

- **Emission Line Comparisons**
- **All galaxies**
- **sSFR ≥ 3.13x10^{-10}**
- **sSFR < 3.13x10^{-10}**
- **2.6 > C ≥ 2.47**
- **C < 2.47**
- **M_{star} ≥ 3.9x10^{9}**
- **M_{star} < 3.9x10^{9}**

**Axes:**
- **L (10^{36} erg/s/arcsec^2)**
- **[NI]/Ha**
- **z/b_e**

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MaNGA galaxies can be used to study the average properties of the halo out to several Re

- Split the current sample in half to unveil trends about diffuse ionized gas
- By stacking MaNGA galaxies and comparing subsamples, we can help solve the mysteries of the origin of eDIG
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Gas Velocities (DAP)
Gas Velocity Dispersions (DAP)
Other Halo Properties

![Graphs showing Halo Properties](image_url)