CNO Abundance Analysis in Nearby Galaxies (UV–Optical)

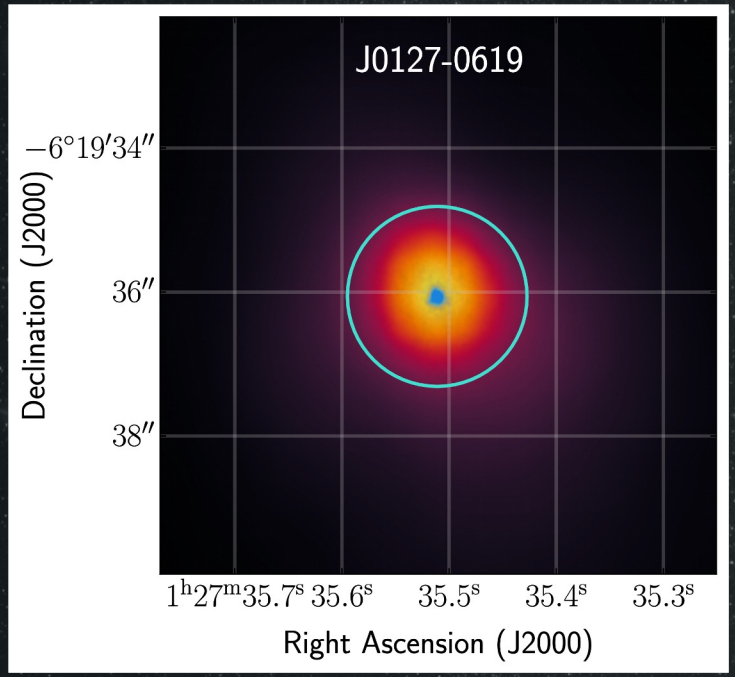
C. BRACCI, E. LENTINI, L. ROOS, G. VALÉ ARTEAGA

Supervisor: Danielle BERG

Introduction

- Dwarf Galaxy with Wolf-Rayet (WR) stars
- Nitrogen-enriched galaxy
- Part of the CLASSY survey

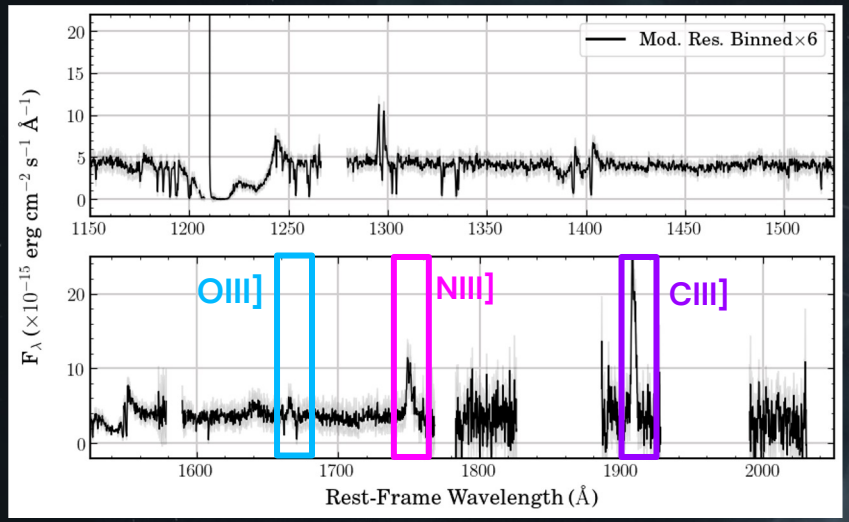
Redshift	0.0054
log $M_\star$	8.74 $M_\odot$
log SFR	-0.75 yr^{-1}
Metallicity	0.10 $Z/Z_\odot$



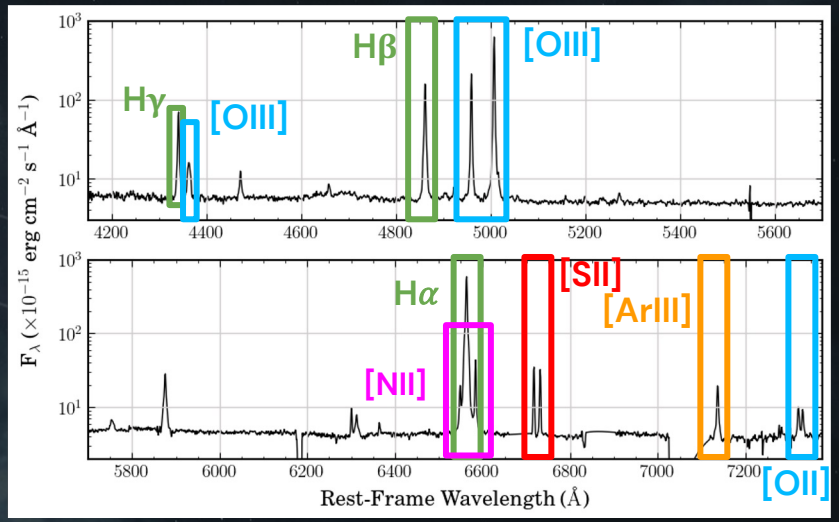
Mrk 996 - credit: CLASSY

The Spectra

UV-Spectrum



Optical Spectrum



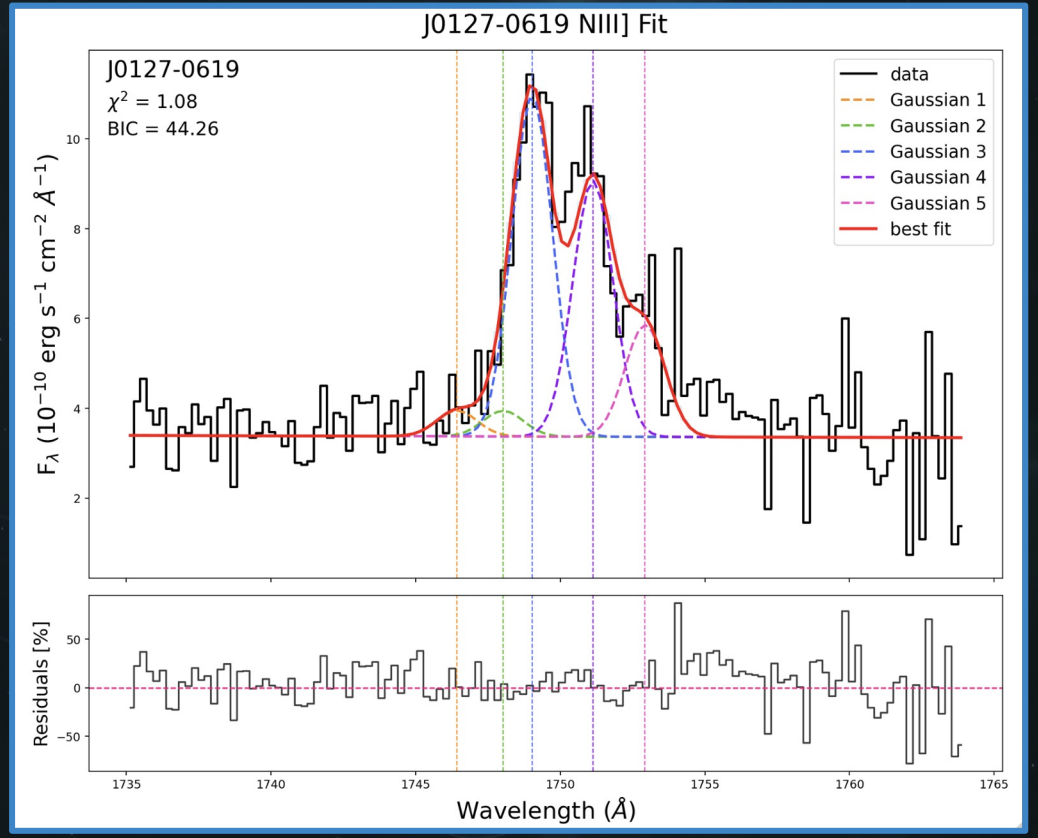
- Archival + new HST/Cosmic Origins Spectrograph (COS) datasets
- Spectra are coadded, then binned by the largest common native resolution of the COS FUV+NUV instruments

Methods: Line fitting

01 **Uv lines**: O III], NIII], CIII]
Optical lines: HI, [OIII], [NII], [SII], [OII]

02 Emission-lines were fit using the **`LMfit`** package.

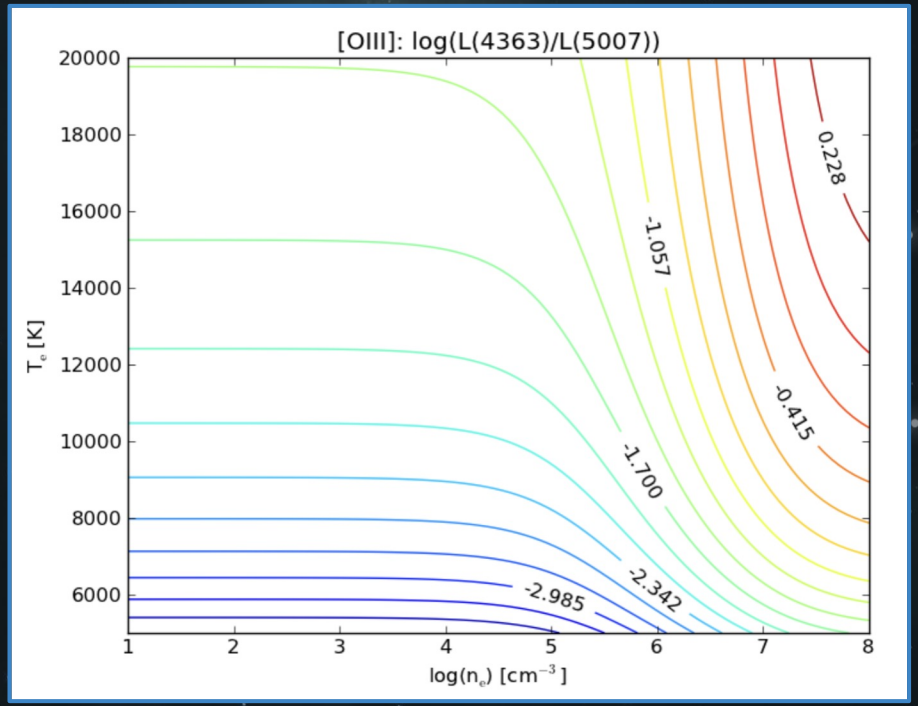
03 From the fit, we measured the lines' fluxes and their error.

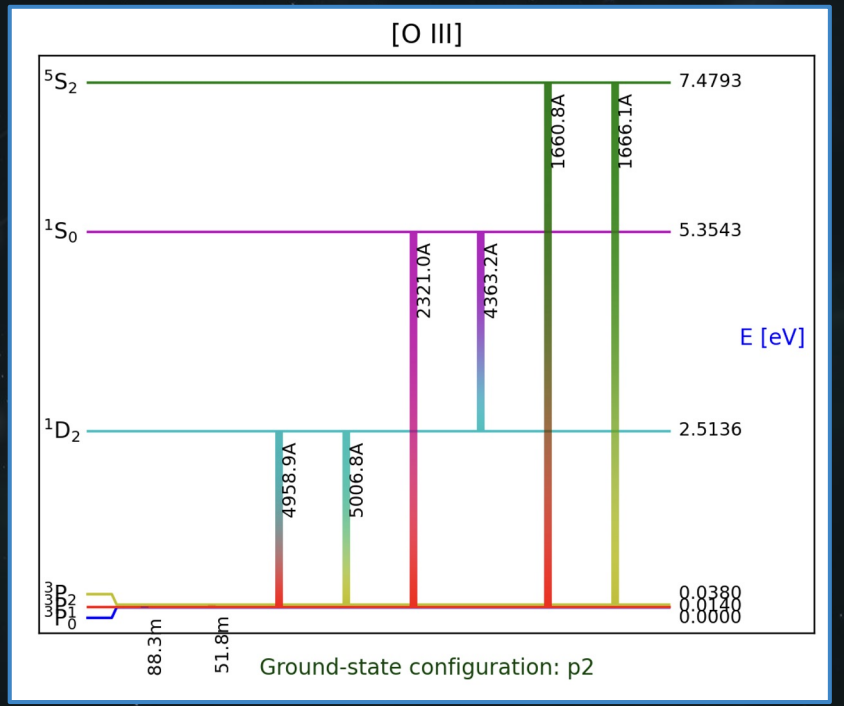


Thanks to Zorayda for the fluxes!

Methods: PyNeb

PyNeb (Luridiana+15) is a package for the analysis of emission lines.

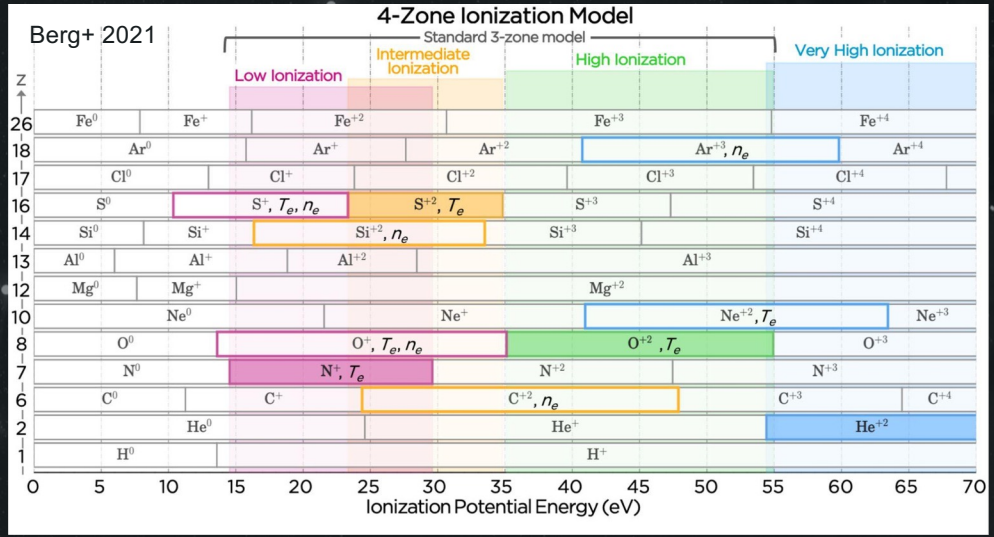




Abundances measurements: direct method

01

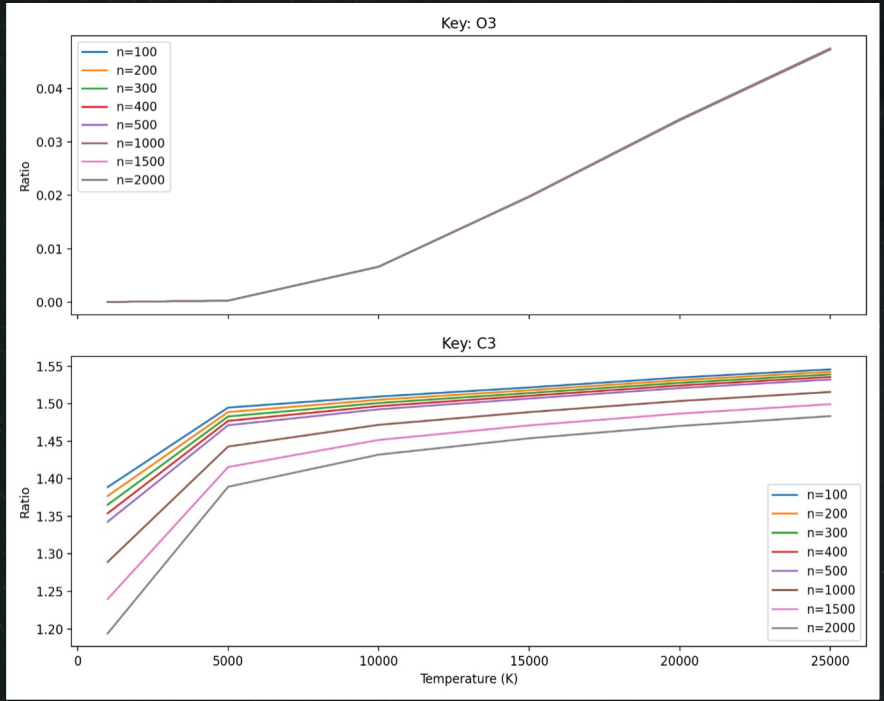
Apply the **4-zone ionization model** to our data



Abundances measurements: direct method

O2

Check how much **ratios change** with temperature and density



Abundances measurements: direct method

03

Starting from the most stable elements, compute **temperature**, **density** and **abundances** for each zone

	Low ionisation	Intermediate ionisation	High ionisation
temperature	[O II] T(OII)=T(OIII)0.7 + 3000	[S III] T(SII)=T(OIII)0.83 +1700	O III] PyNeb
Electron density	[S II] PyNeb	C III] PyNeb	
abundances	[O II] PyNeb [N II] PyNeb	C III] PyNeb [N III] PyNeb	Optical [O III] PyNeb UV O III] PyNeb

Abundances measurements: direct method

03

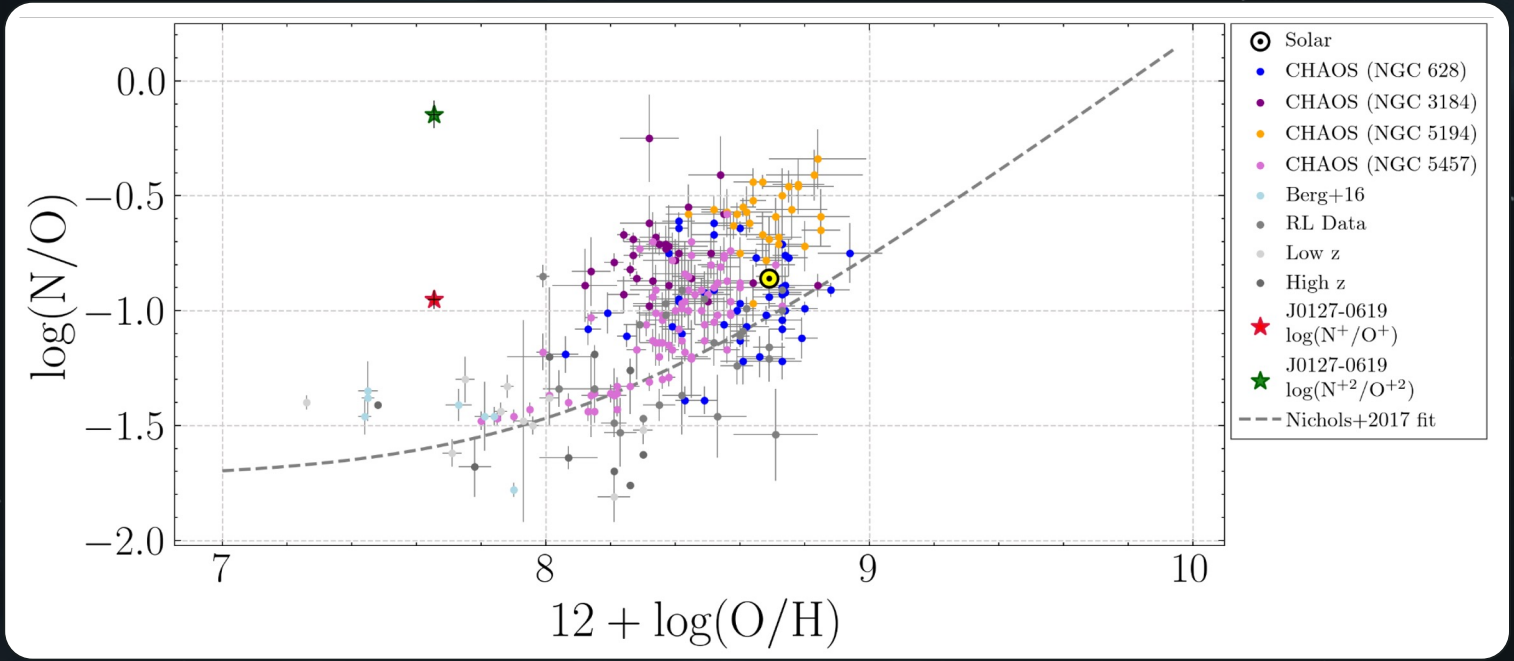
Starting from the most stable elements, compute **temperature**, **density** and **abundances** for each zone

$$LOH = 12 + \left(\frac{O^+}{H^+} + \frac{O^{+2}}{H^+} \right)$$

$$\frac{N^+}{O^+} = \frac{N^+/H^+}{O^+/H^+} ICF(N^+/O^+)$$

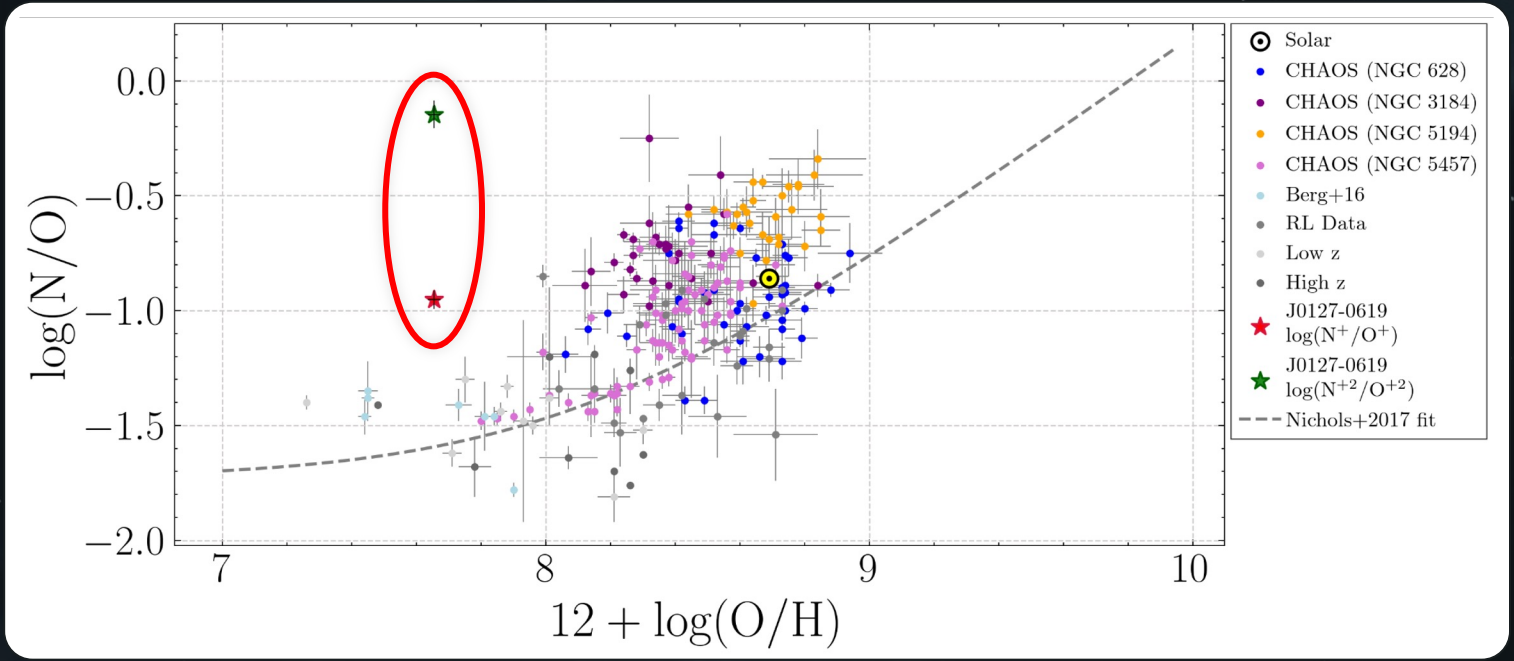
$$\frac{N^{+2}}{O^{+2}} = \frac{N^{+2}/H^+}{O^{+2}/H^+} ICF(N^{+2}/O^{+2})$$

Results: N/O–O/H scatter plot



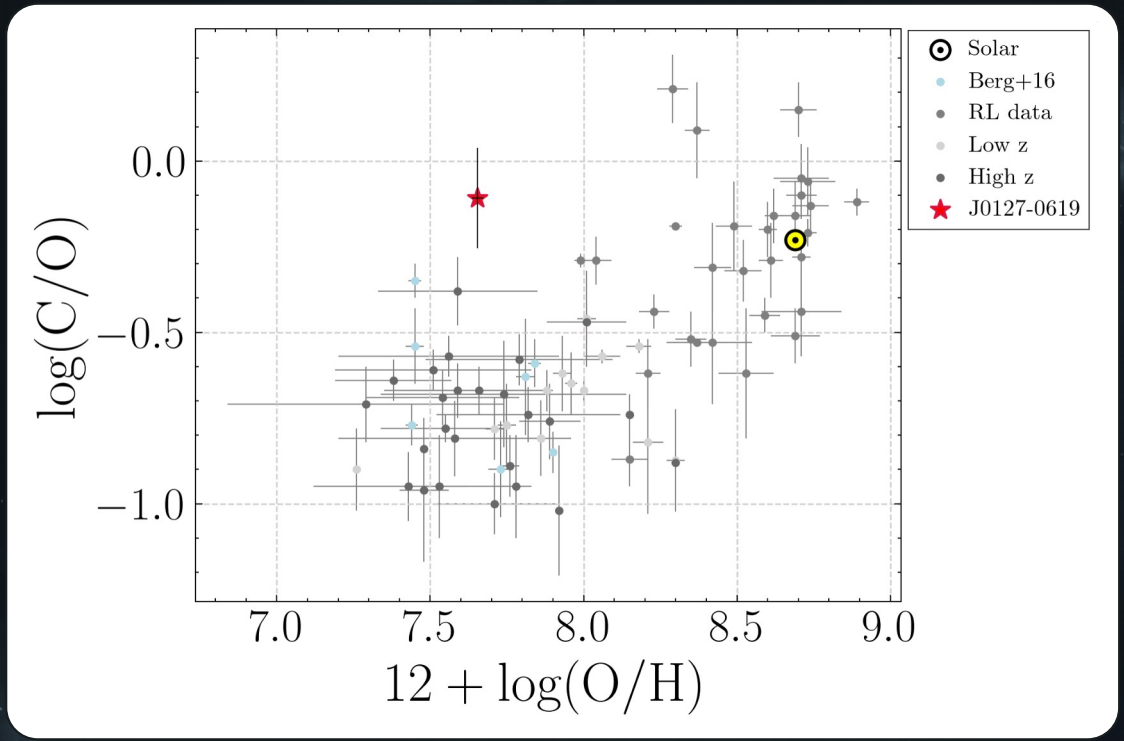
12+log(O/H) = 7.65 ± 0.02 $\log(N^{+}/O^{+})$ = −0.95 ± 0.04 $\log(N^{+2}/O^{+2})$ = −0.15 ± 0.06

Results: N/O-O/H scatter plot



12+log(O/H) = 7.65 ± 0.02 $\log(N^{+}/O^{+})$ = −0.95 ± 0.04 $\log(N^{+2}/O^{+2})$ = −0.15 ± 0.06

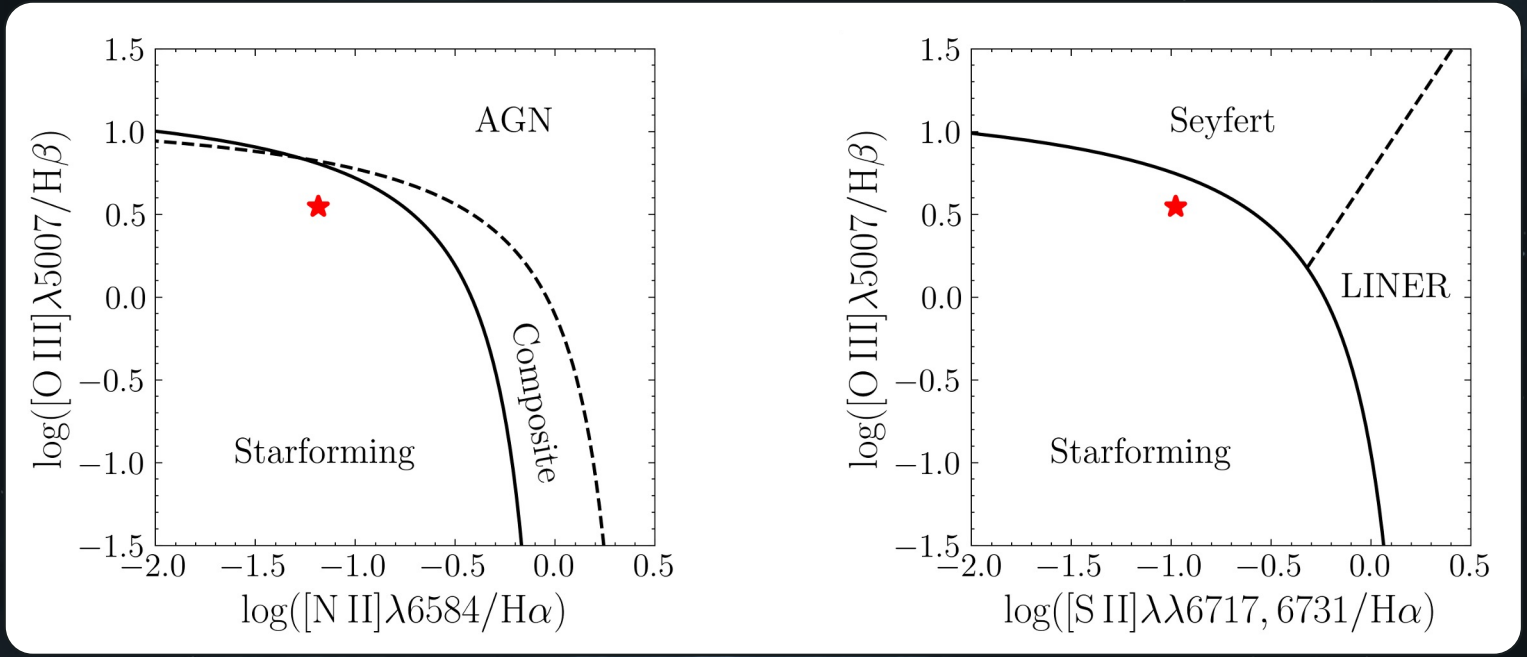
Results: C/O–O/H scatter plot



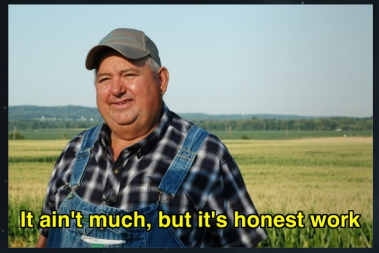
12+log(O/H) = 7.65 ± 0.02

log(C/O) = −0.11 ± 0.14

Results: BPT diagrams



Conclusions



- ★ Enriched Nitrogen Galaxy.
- ★ Snapshot of galaxy between WR and SN.
- ★ High ionization zone Nitrogen can be explained this way.
- ★ High CO abundance.
- ★ BPT shows starforming galaxy.