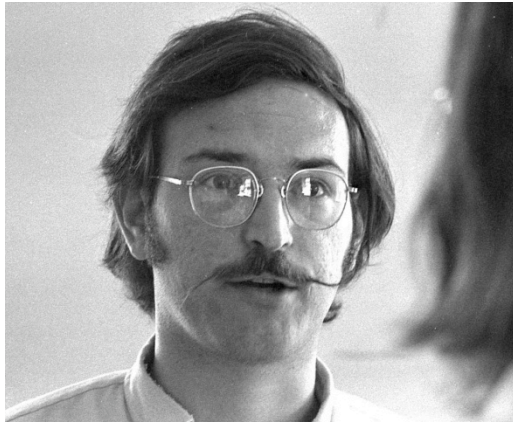# 4He Abundances: Optical vs Radio
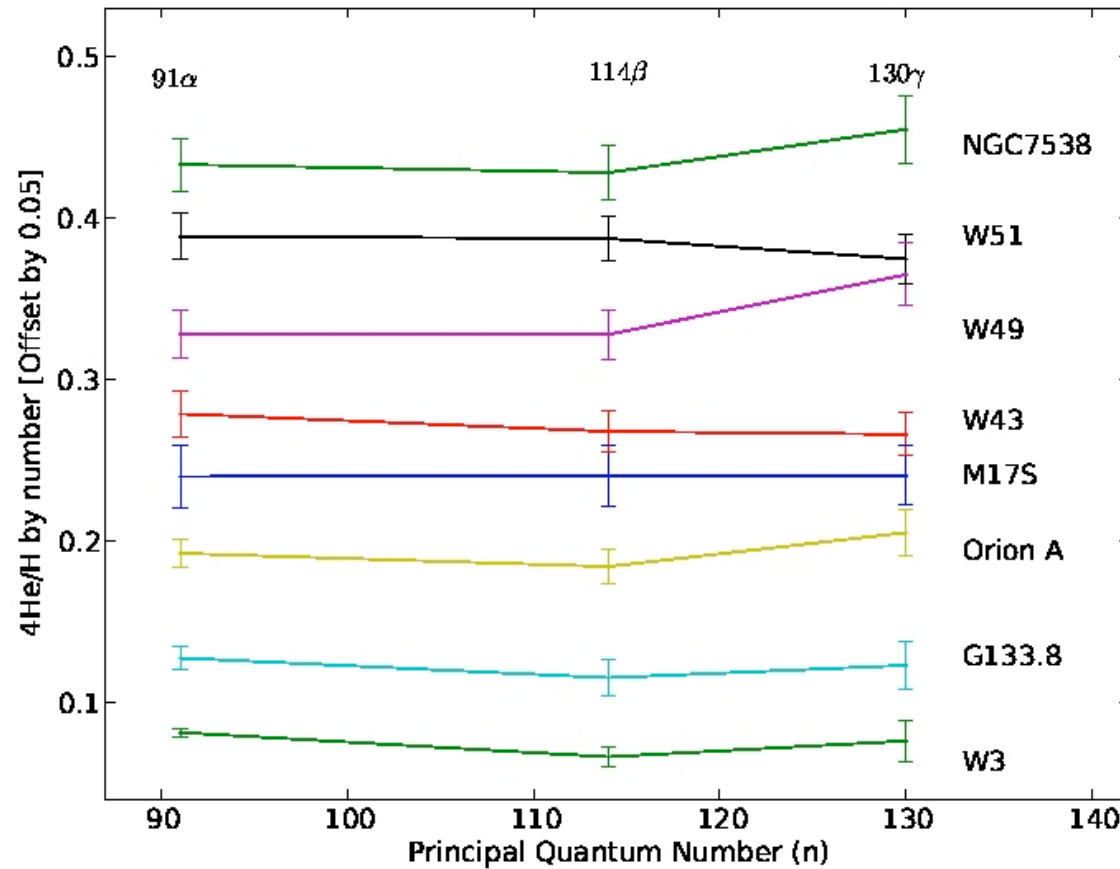# Dana S. Balser

Collaborators

Tom Bania

Bob Rood

Radio Recombination Lines

- Sensitivity
- Spectral Baselines
- Departures from LTE
- Ionization Structure
- Density Structure

4He/H: RRLs with the 140 Foot Telescope

Peimbert et al. (1992)

Radio Recombination Lines

- Sensitivity
- Spectral Baselines
- Departures from LTE
- Ionization Structure
- Density Structure

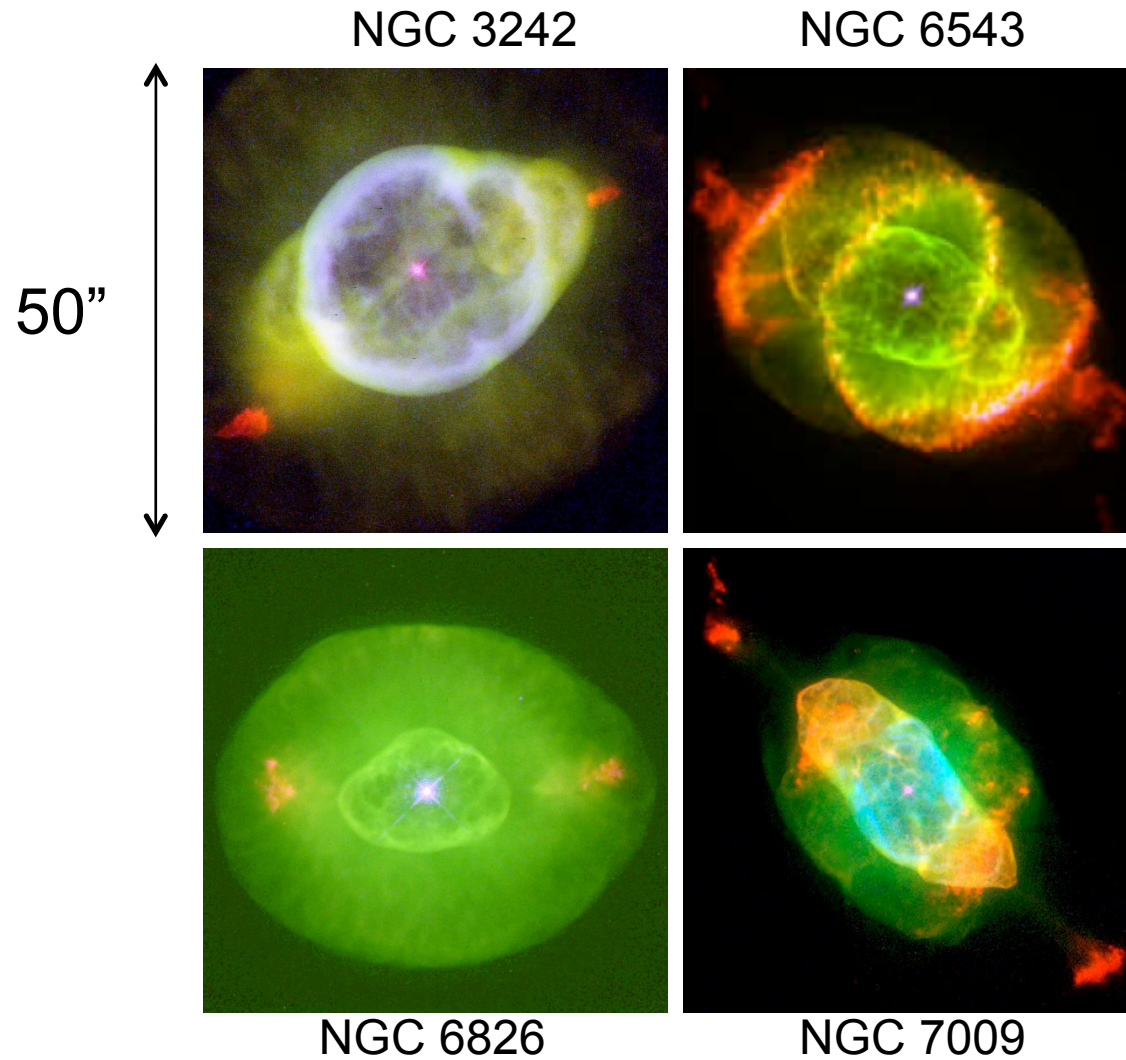# Green Bank Telescope Observations

Planetary Nebulae :

  NGC 3242

  NGC 6543

  NGC 6826

  NGC 7009

HII Regions :

  M17

  S206

GBT HPBW $= 80''$ at 9 GHz

H and He $87\alpha - 93\alpha$

Planetary Nebulae
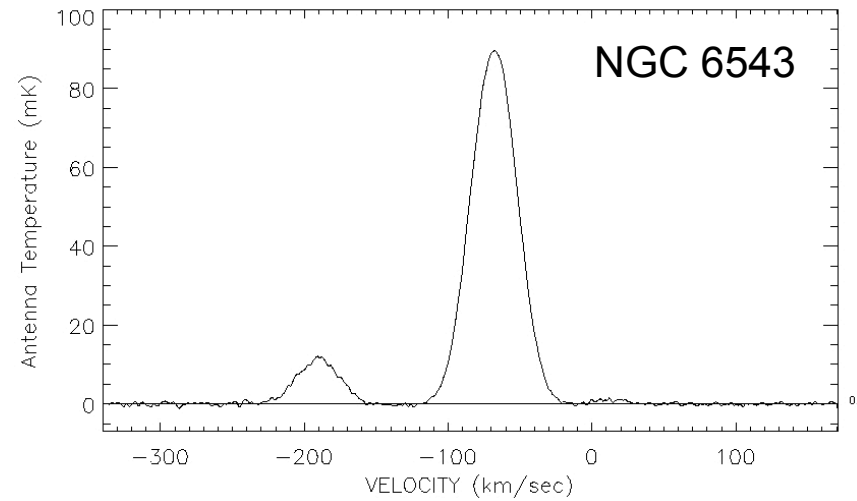
NGC 3242

NGC 6543

50"

NGC 6826
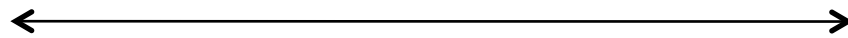
NGC 7009

Balick et al.

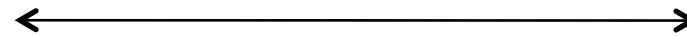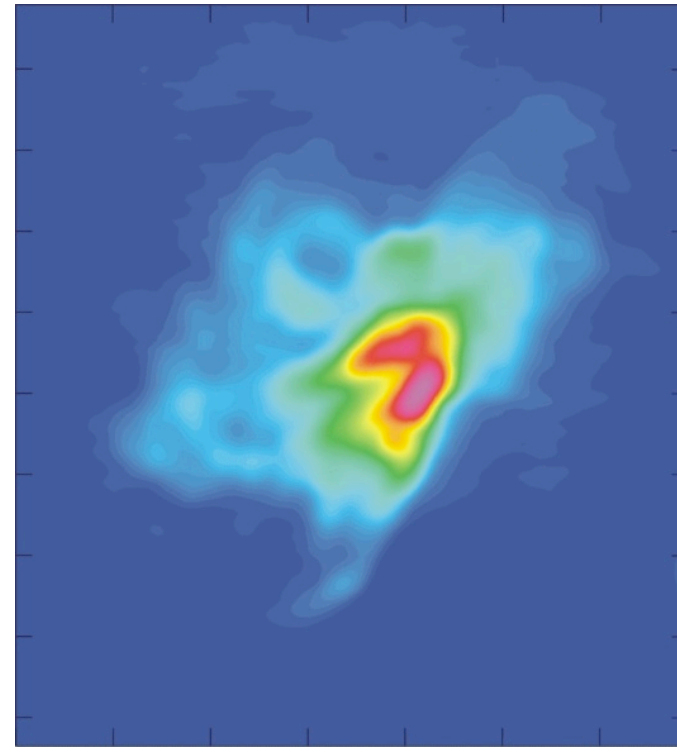# GBT: PNe Radio Recombination Lines
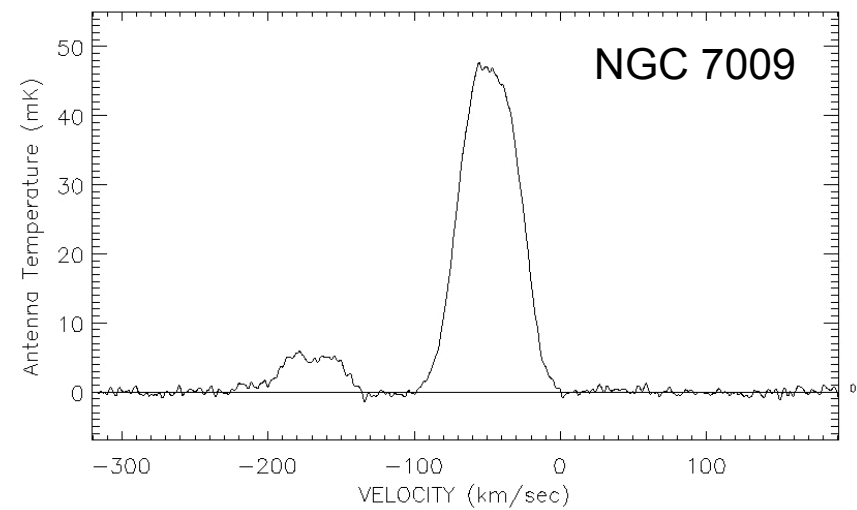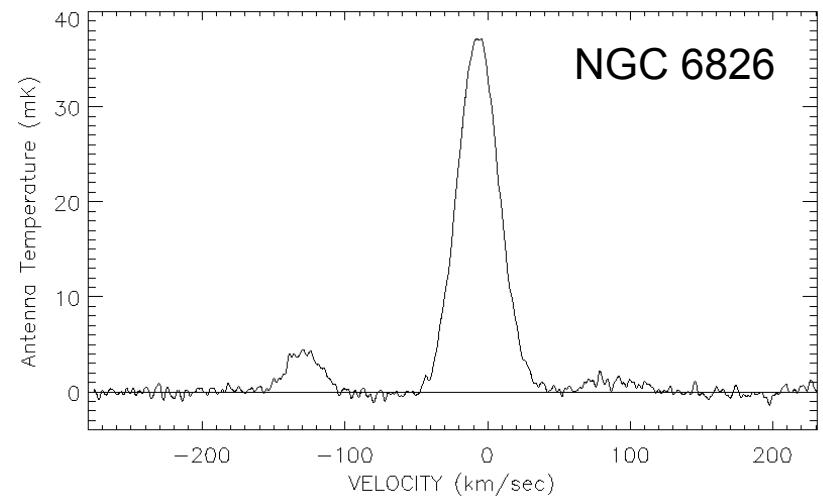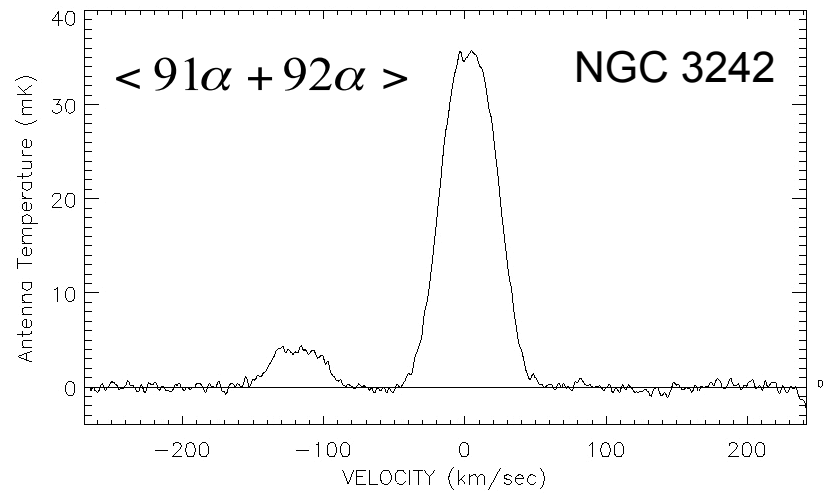
HII Regions: M17

Optical (Halpha)

30'

MacQuarrie

Radio Continuum (9GHz)

60'
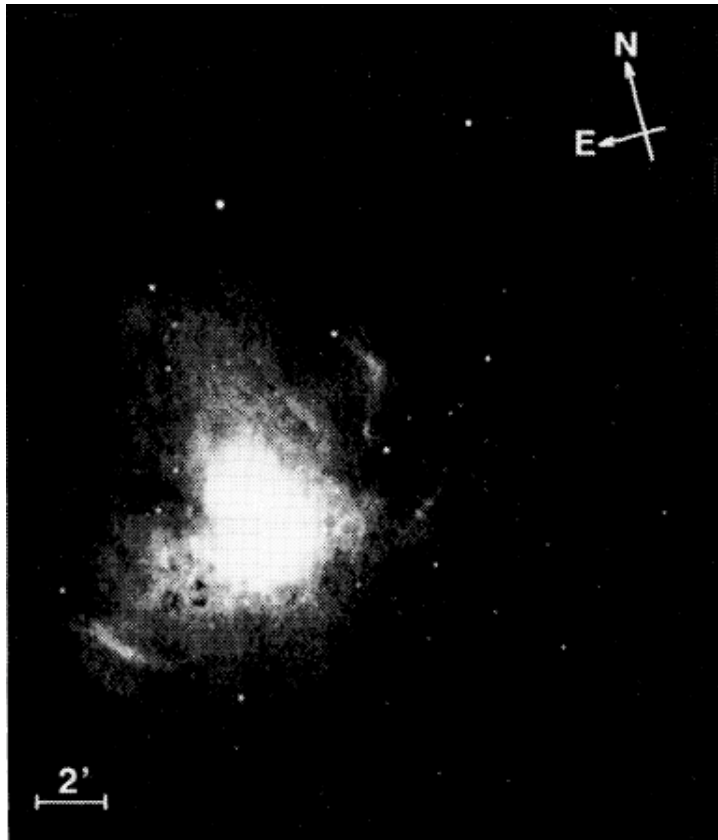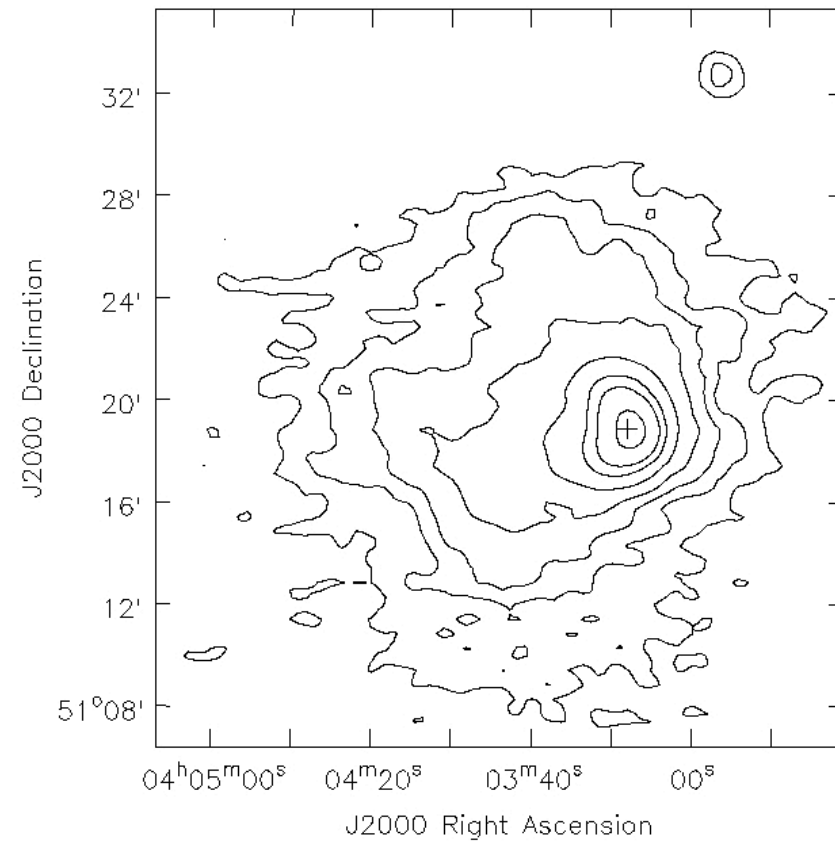
Maddalena et al.

HII Regions: S206

Optical (Halpha)

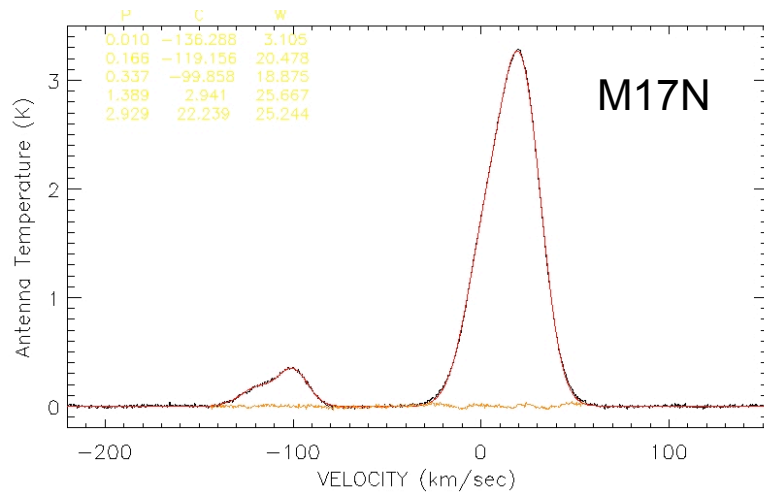### Radio Continuum (9 GHz)
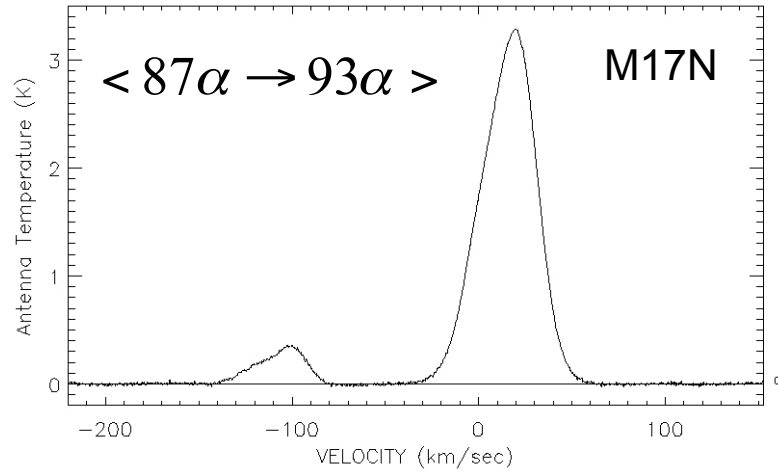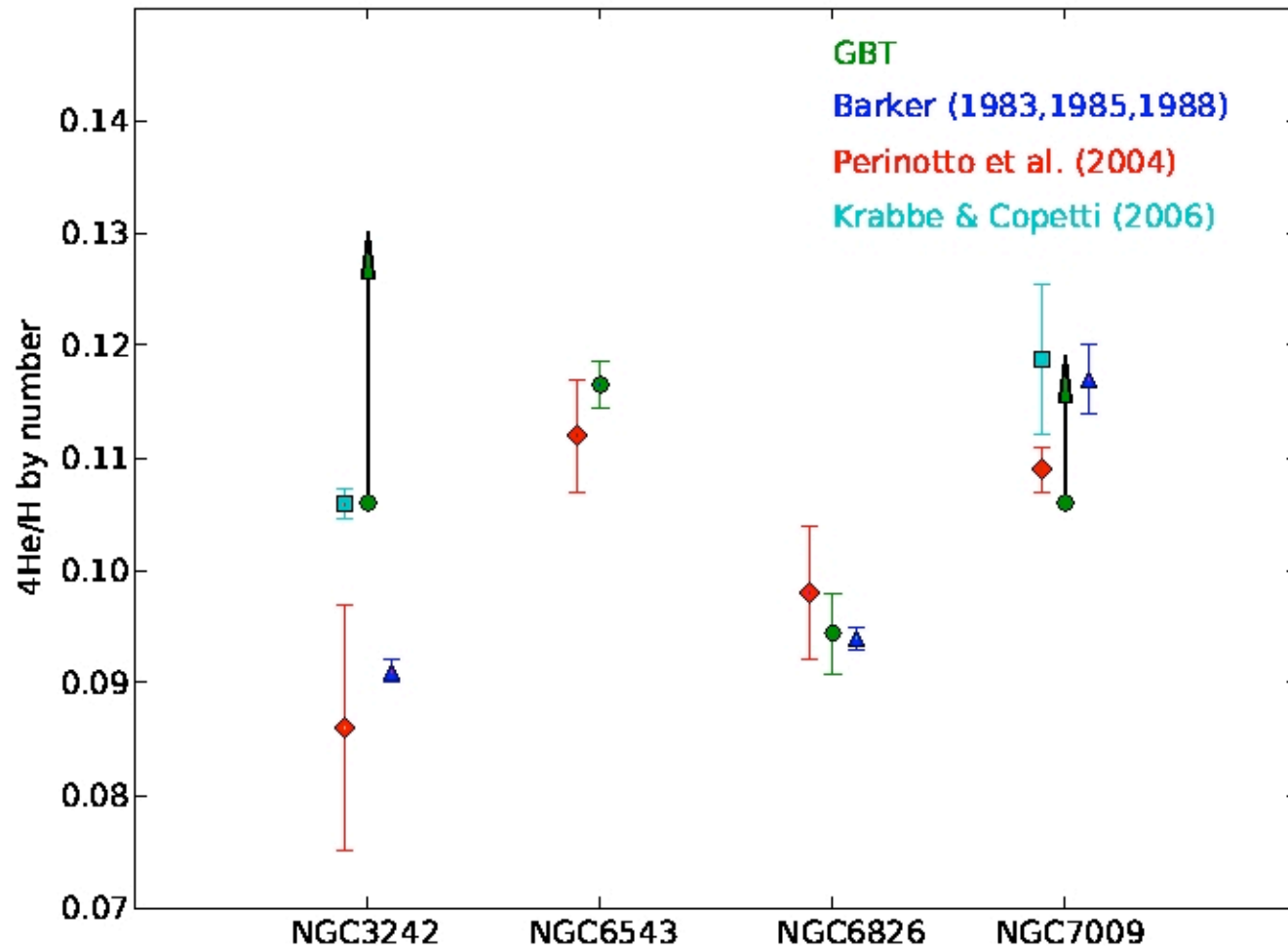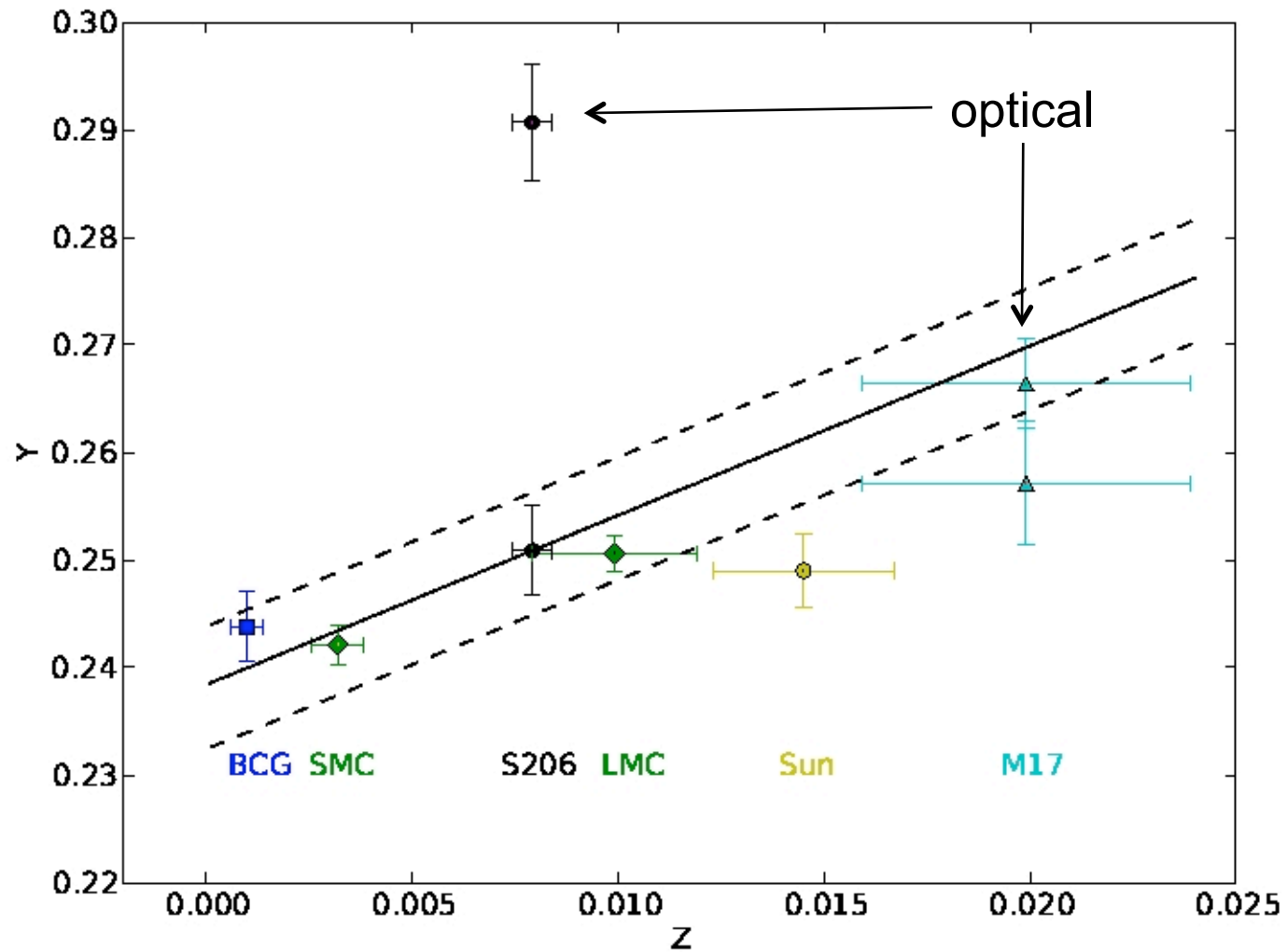

Pismis & Mampaso (1991)

Balser (2006)

GBT: HII Region Radio Recombination Lines
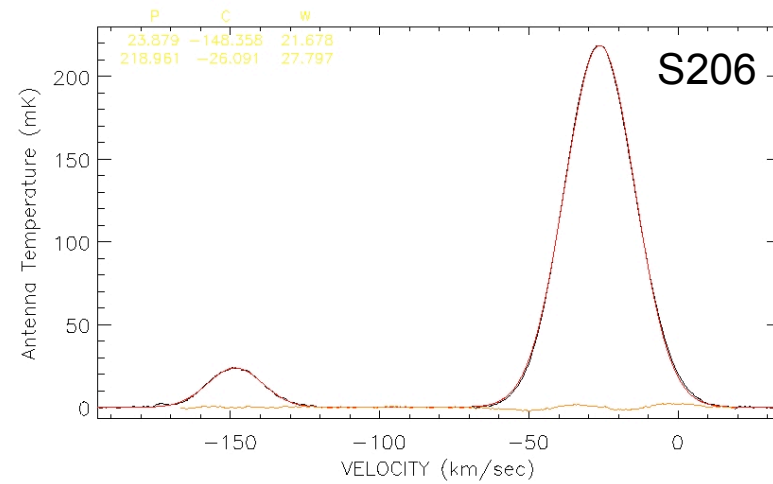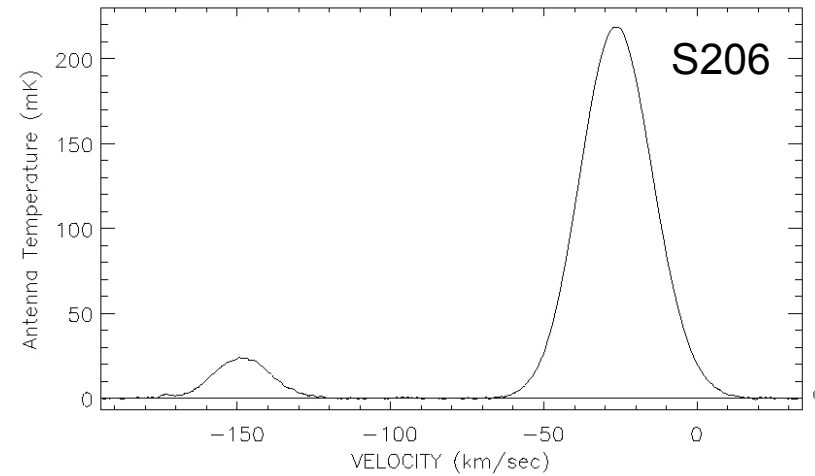
4He/H: Planetary Nebulae

4He/H: HII Regions

Summary

- 4He/H differences as large as 15-20% between Optical and Radio

- Galactic dY/dZ ~ 1 (M17, S206)

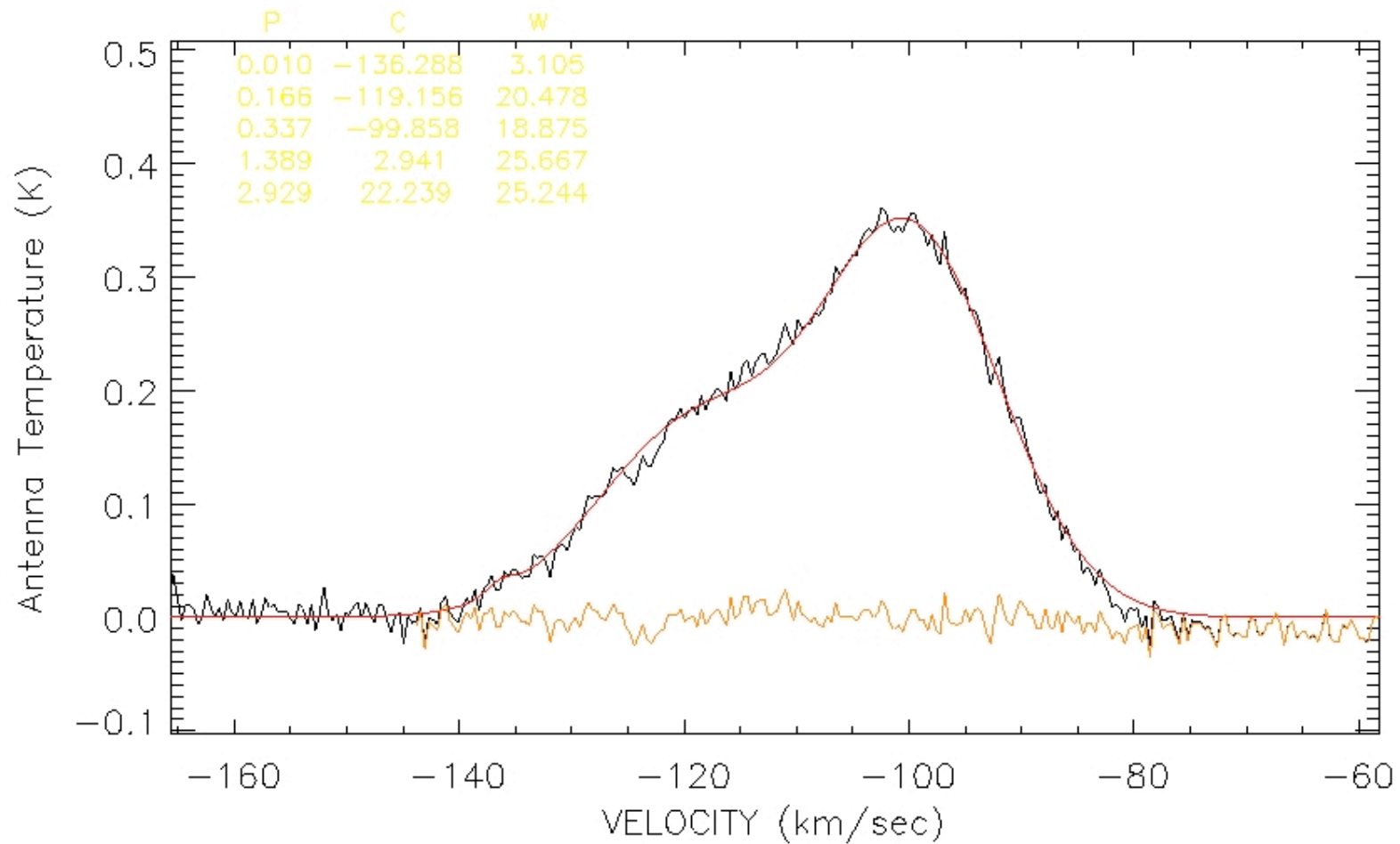# Future Work

- Explore 4He/H with n
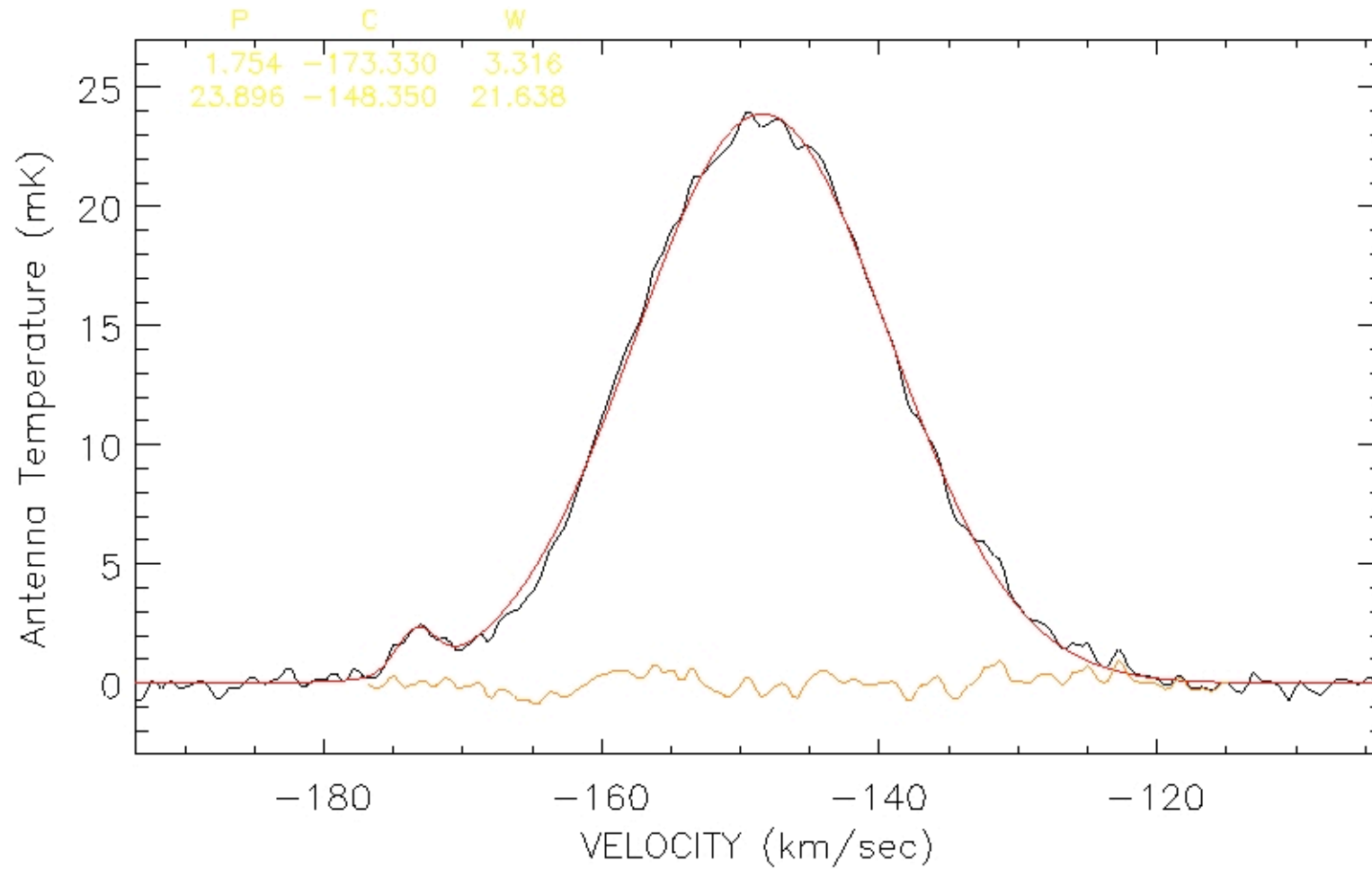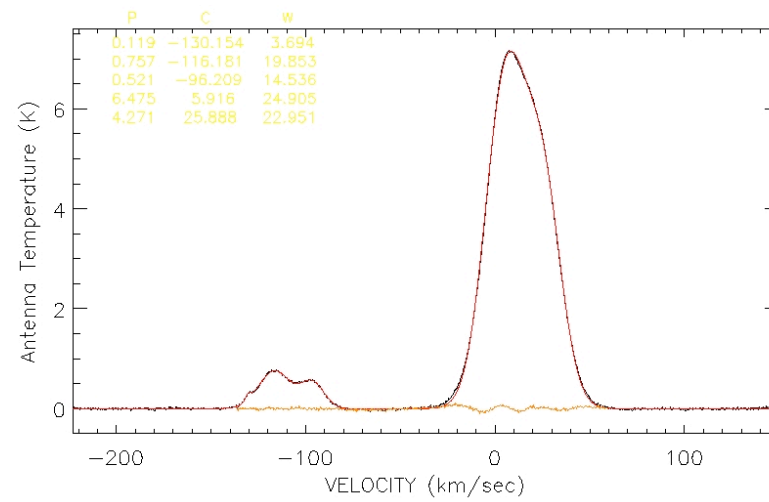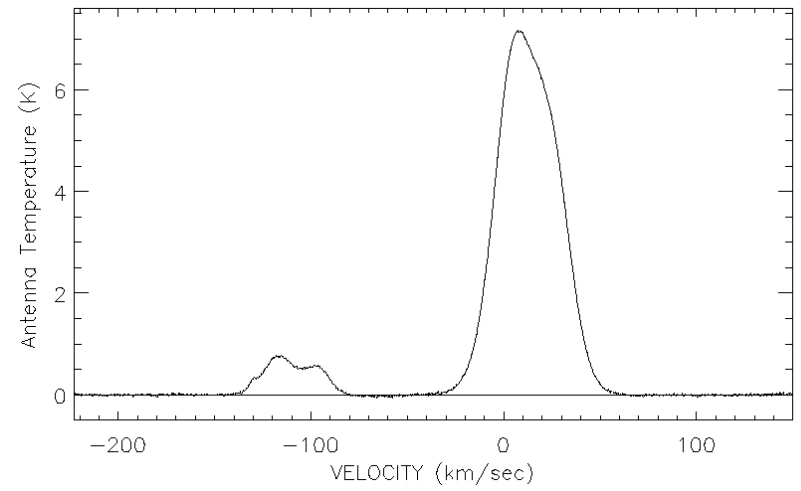- Models of PNe and HII Regions
- EVLA

Extra Slides

Expanded View: M17N

Expanded View: S206

M17S

Expanded View: M17S