

The CHemical Abundances Of Spirals

(CHAOS)

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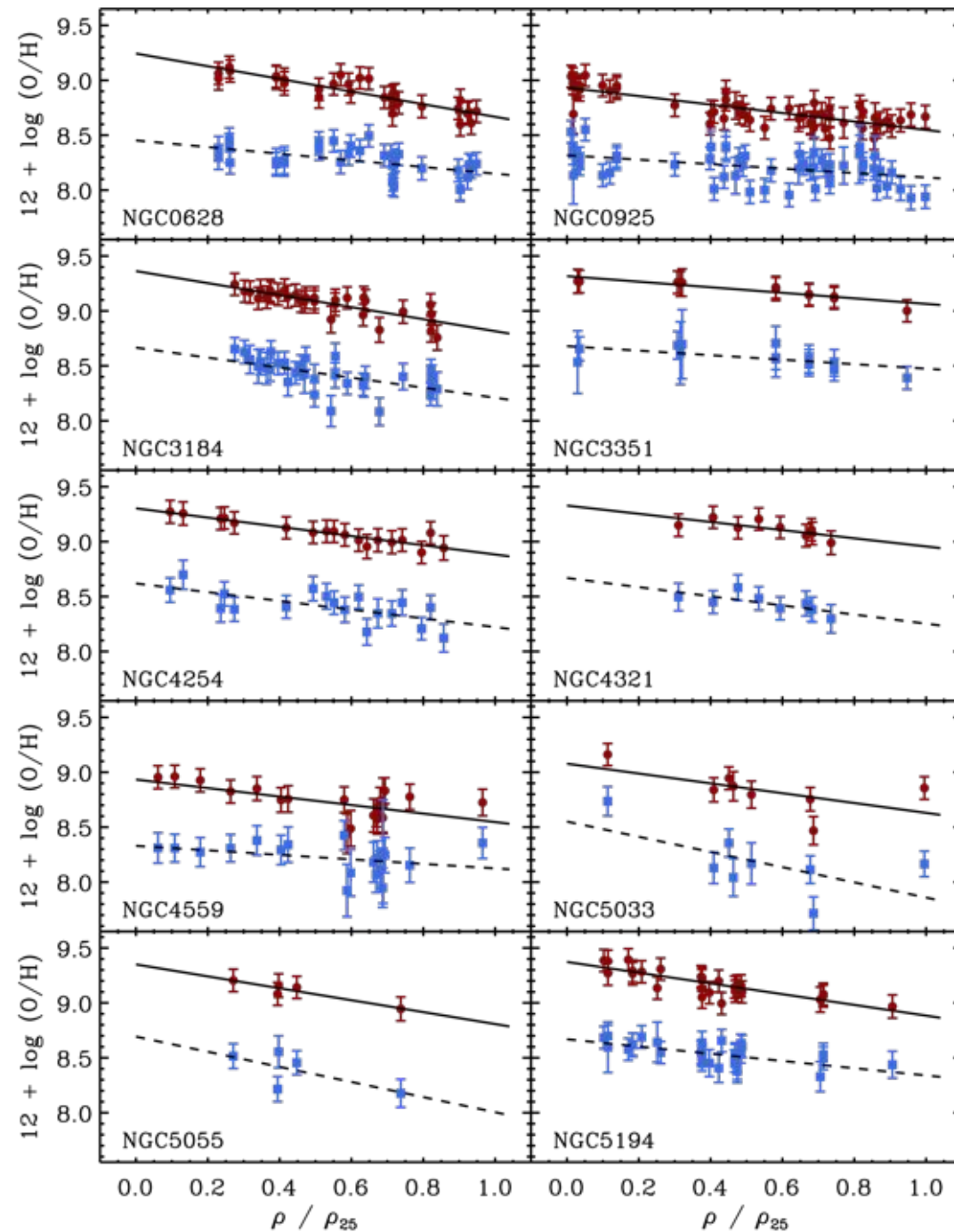
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(Siena College)

The Chemical Abundances Of Spirals

The CHAOS project will use the LBT/MODS to conduct a survey of high signal/noise spectra of 1000 HII regions in 13 spiral galaxies chosen from the Spitzer Infrared Nearby Galaxies Survey (SINGS, Kennicutt et al. 2003b). These spectra will allow us to use multiple emission line diagnostics to determine the physical conditions in the HII regions, such that absolute and relative chemical abundances can be determined with uncertainties less than 0.2 dex, and to analyze the chemical abundance gradients and the dispersions in the HII region abundances at a given radius. By comparing these observations with disk-galaxy formation models we will place fundamental constraints on the gas accretion and star formation histories of disk galaxies.

CHAOS Motivation

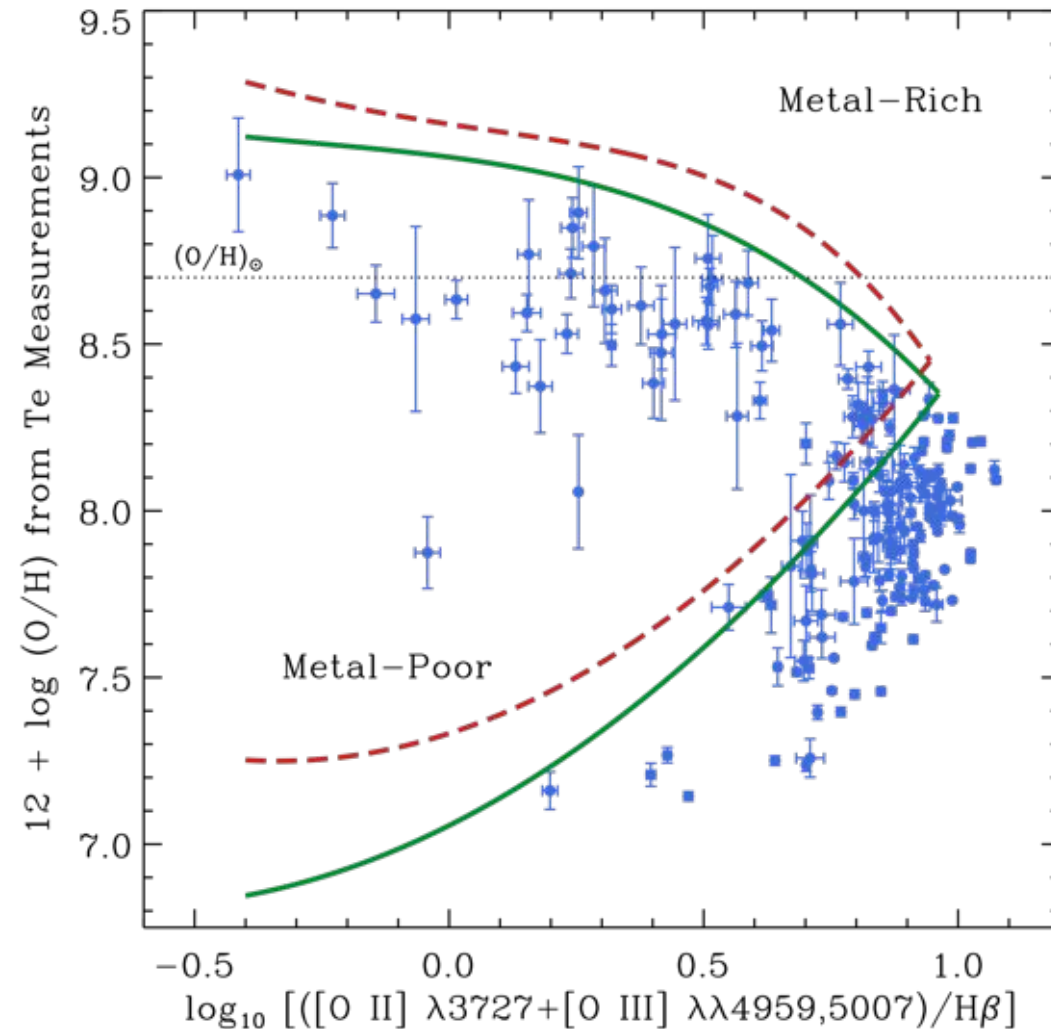
SINGS galaxies have beautiful observations at almost every very wavelength, but most of them have abundance information based on strong line methods.



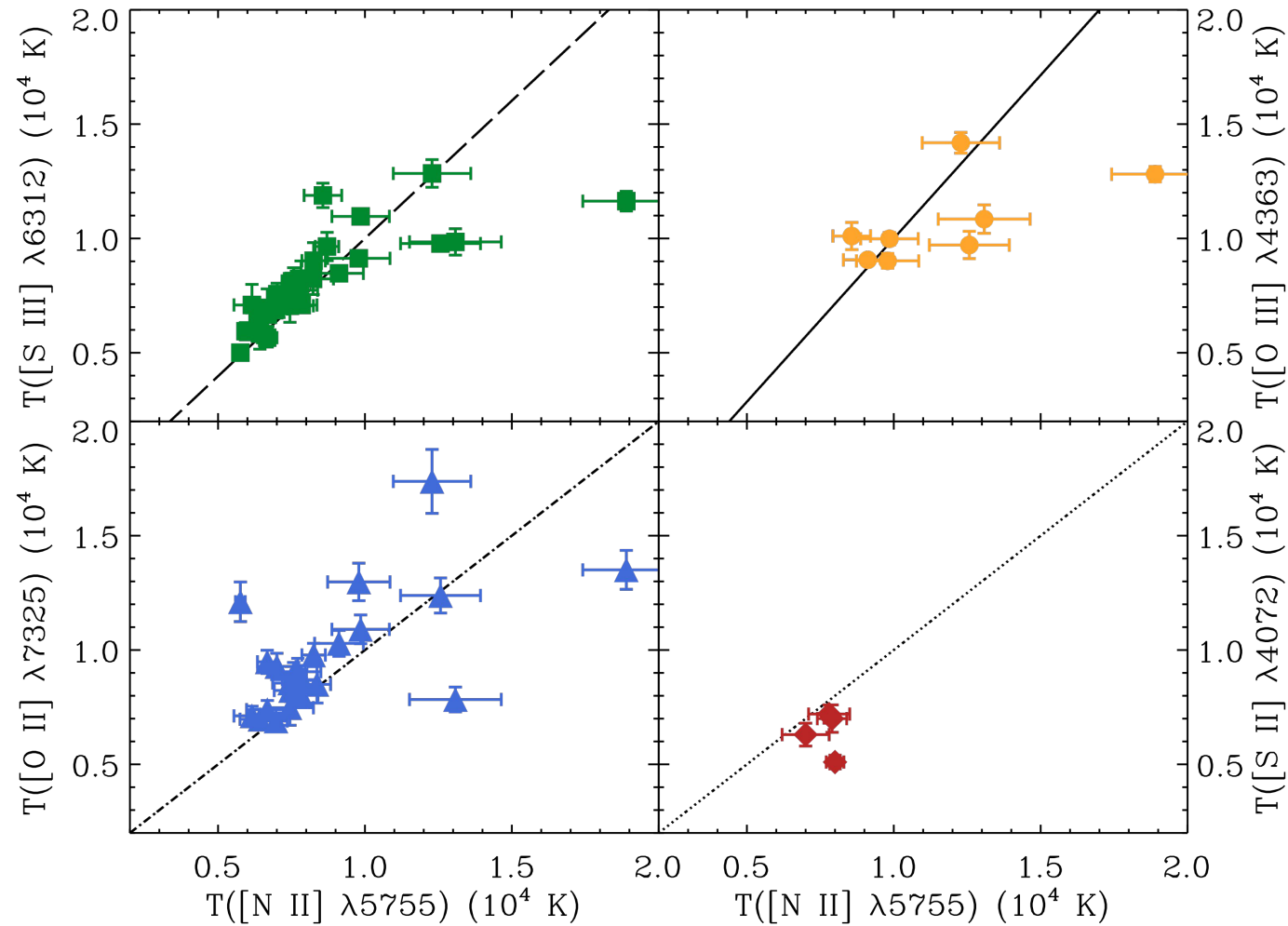
CHAOS Motivation

SINGS spirals have HII regions precisely in the regime where strong line methods are most problematic.

Direct abundances will be a great help (see Bresolin papers and talk on Friday).

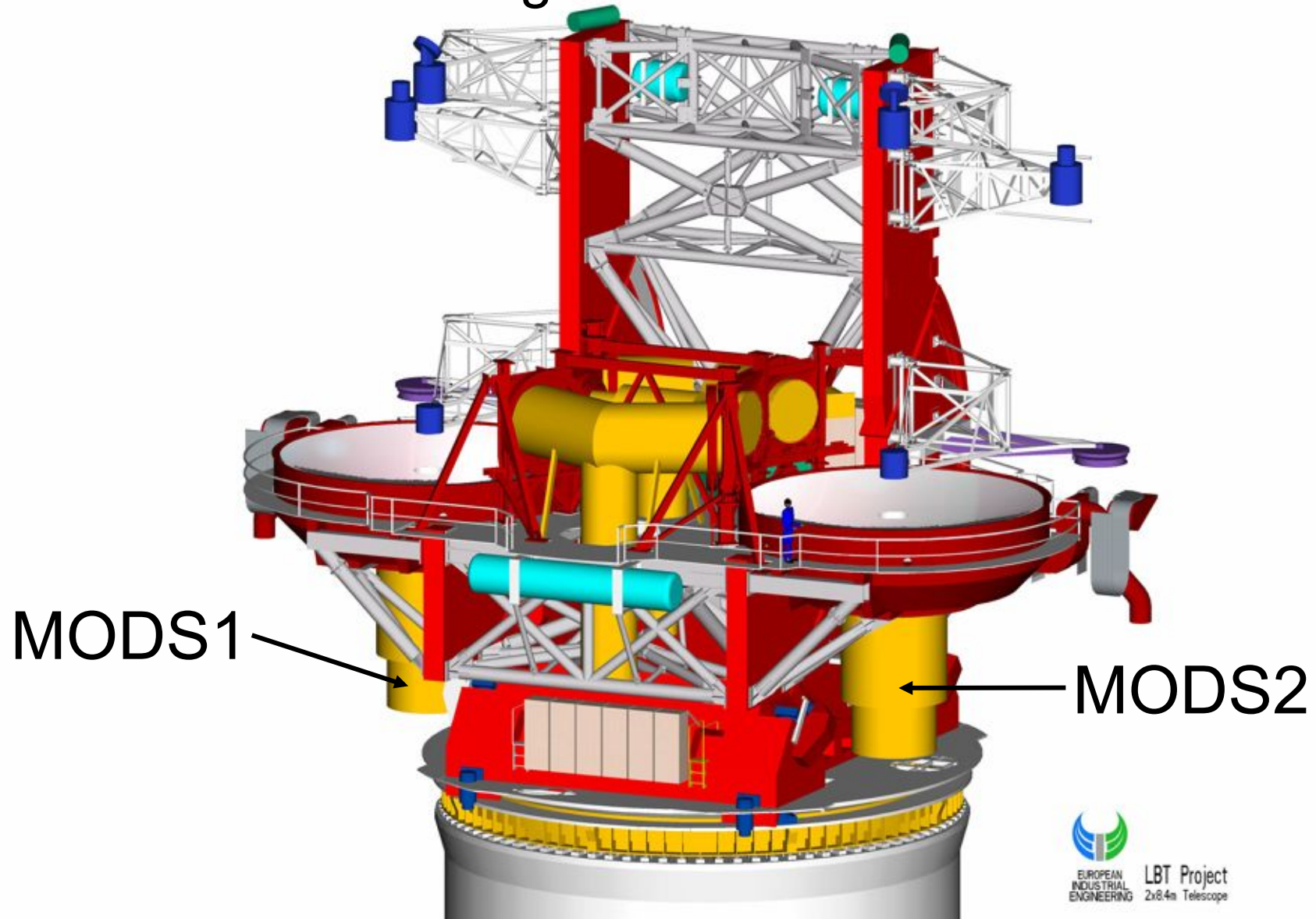


CHAOS Motivation



CHAOS observations of SINGS spirals will provide a large, uniform database of high quality spectra. These will be useful for HII region diagnostics.

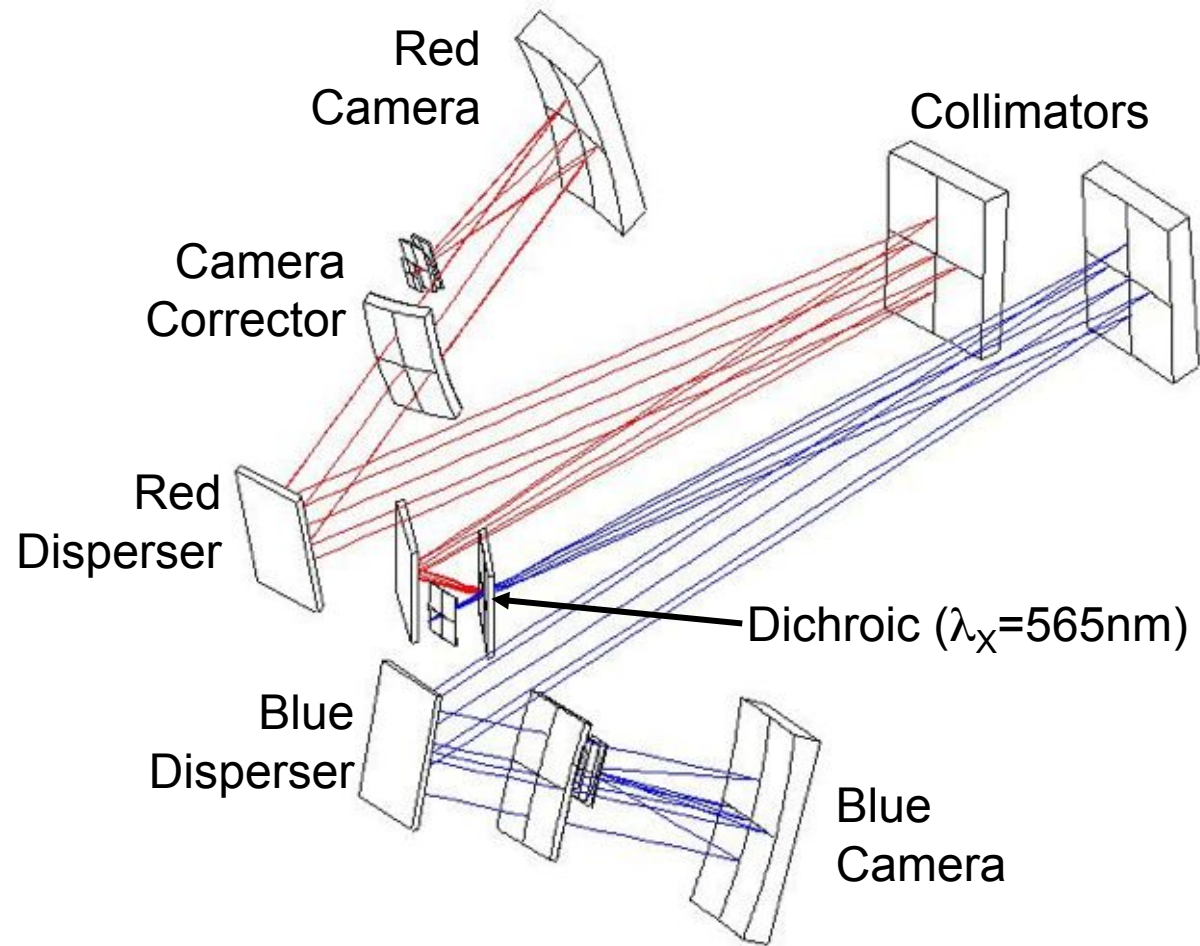
MODS: Multi-Object Double Spectrographs for the LBT f/15 Direct Gregorian foci



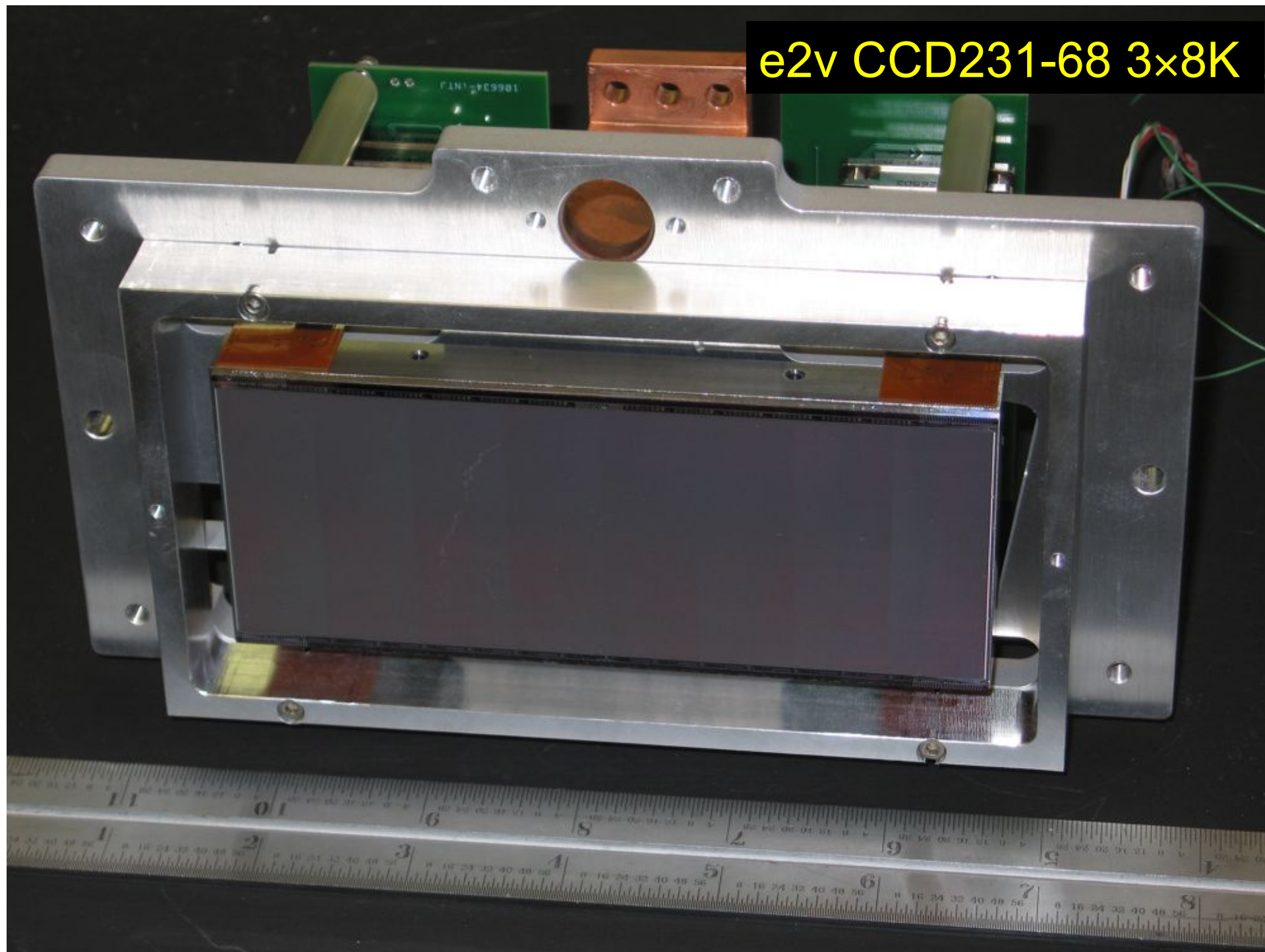


Richard Pogge (OSU) with MODS1 at the LBT Left Direct Gregorian Focus – 2011 April 13

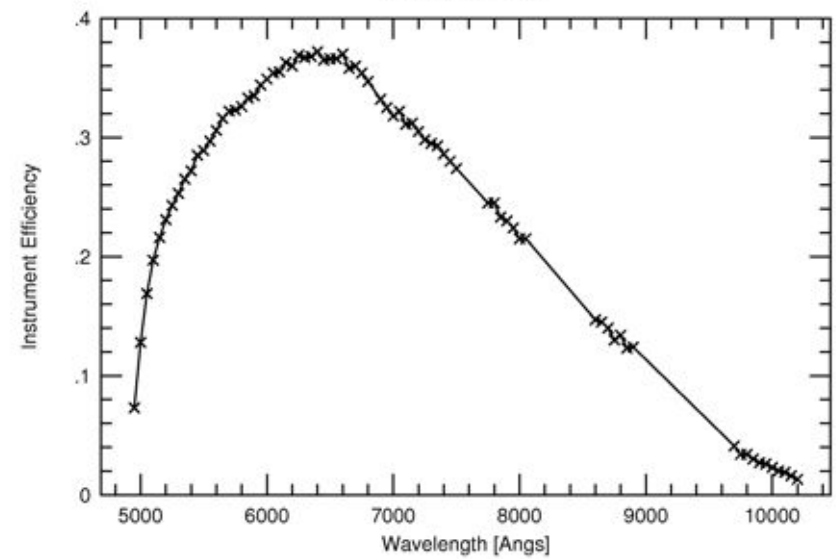
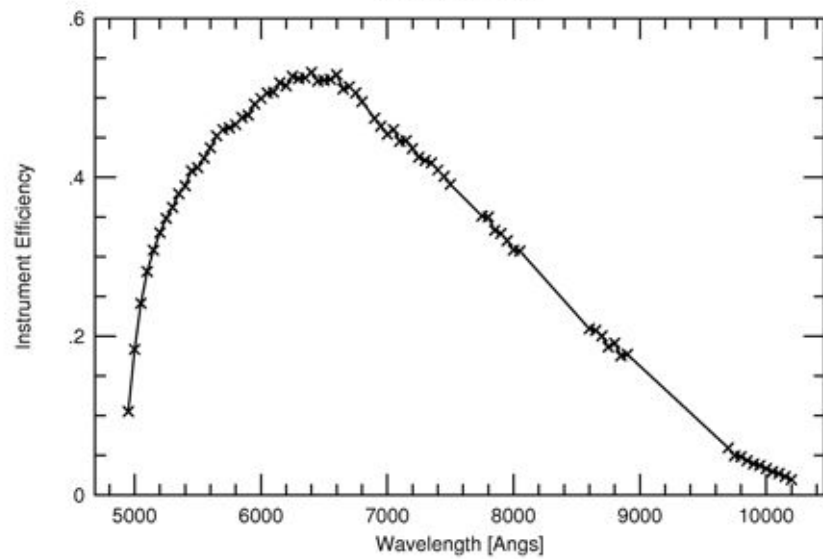
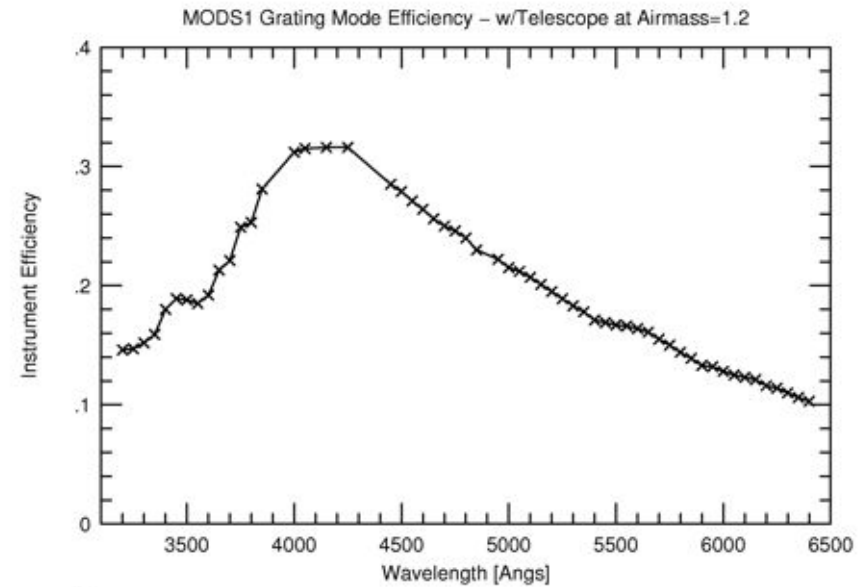
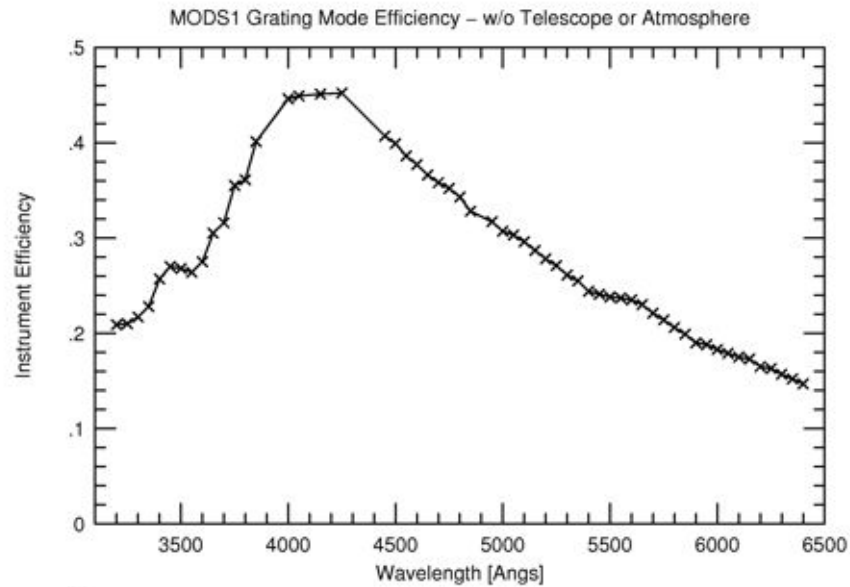
MODS is a high-throughput variation on the classic Oke-Gunn Double Spectrograph



e2v CCD231-68 3x8K

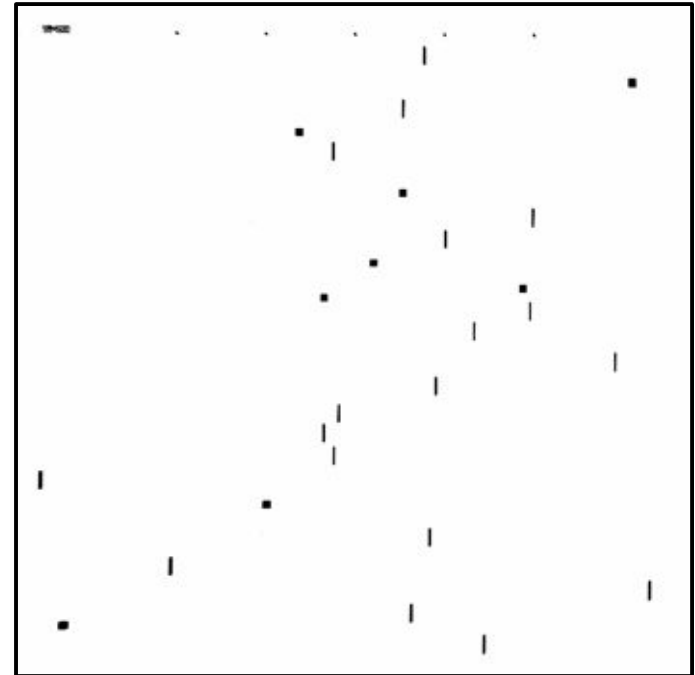


The optical system is optimized for high throughput

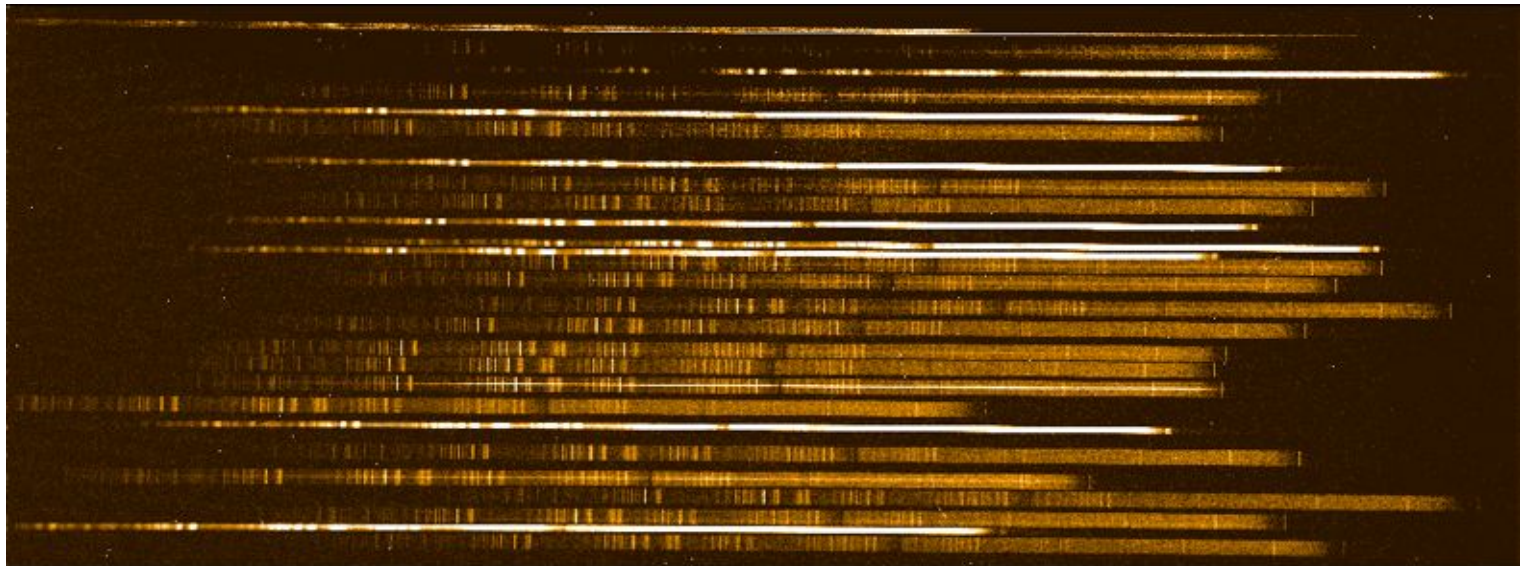


System efficiency measured on-sky with flux standard stars

MODS multi-slit masks are laser cut in spherical Nickel/Cobalt (Nicolloy) blanks



Abell 1689 Red MOS Spectrum (2011 March 17)

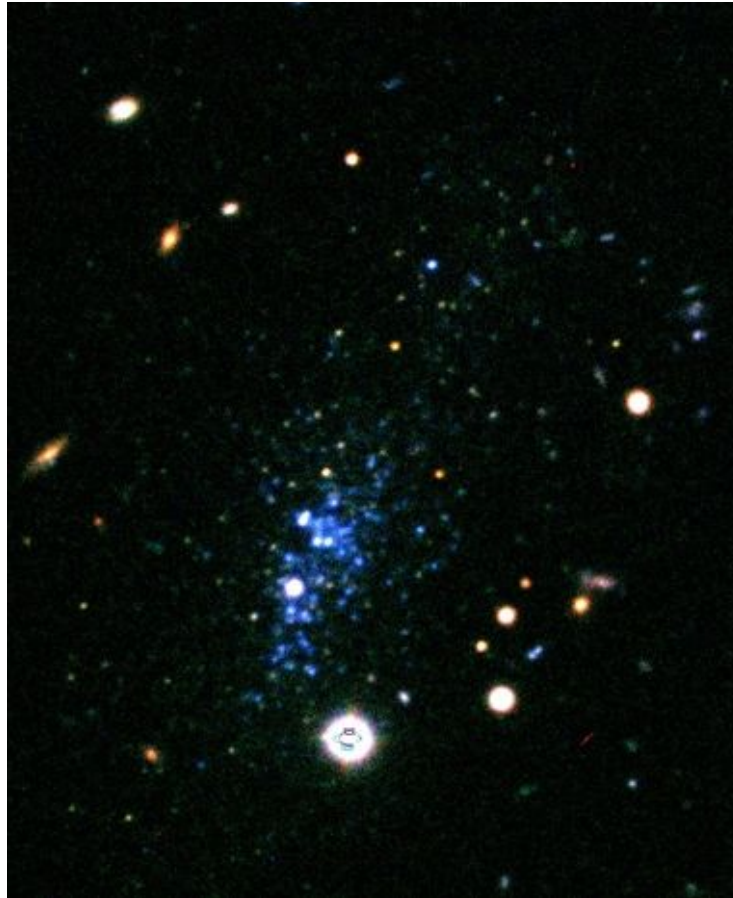


Example Spectrum?

CHAOS primary targets: NGCs 628, 925 (2), 3184 (1),
3351, 3627, 3938 (1), 4254, 4321, 4559, 4579, 5033,
5055, 5194 (1)

Pause for effect.

A New Dwarf Galaxy in the Local Group?



Riccardo Giovanelli, Martha Haynes, Betsey Adams (Cornell)

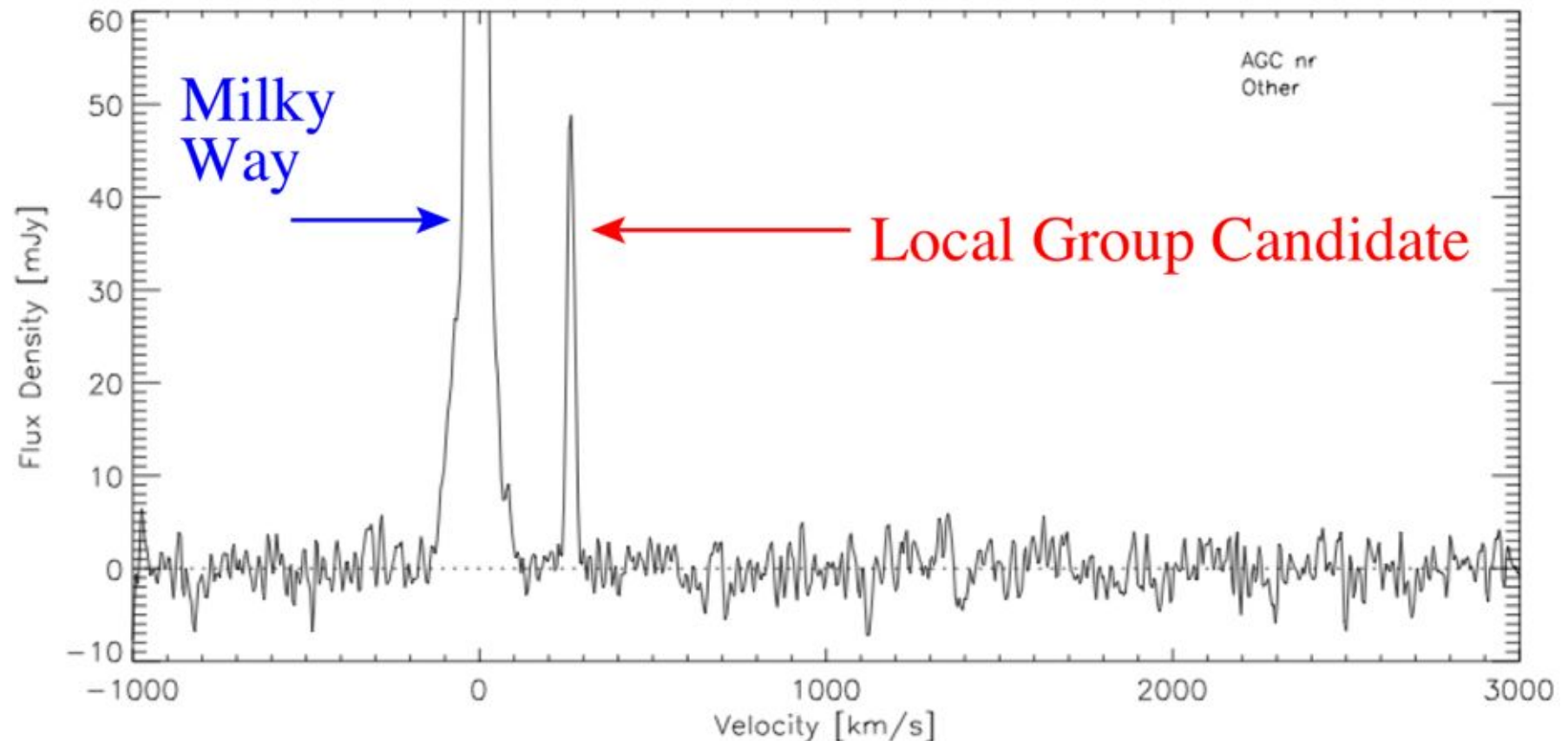
John Cannon, Elijah Z. Bernstein-Cooper (Macalester)

Kristy McQuinn, Danielle Berg, Evan Skillman (Minnesota)

John Salzer, Nathalie Hauerberg, Kathy Rhode, Angela van Sistine (Indiana)ana)

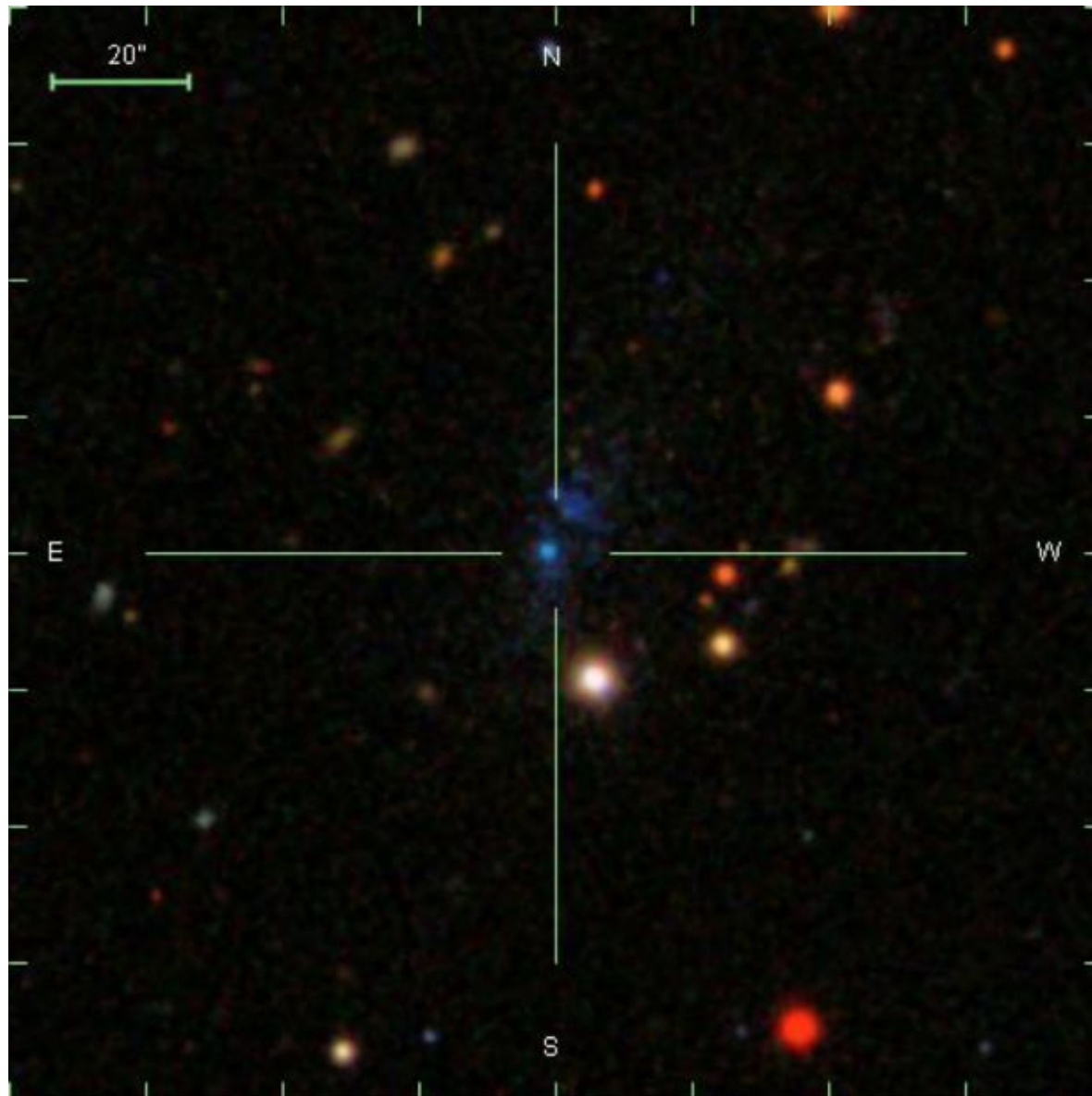
Rick Pogge (OSU)

New Dwarf Galaxy in the Local Group?



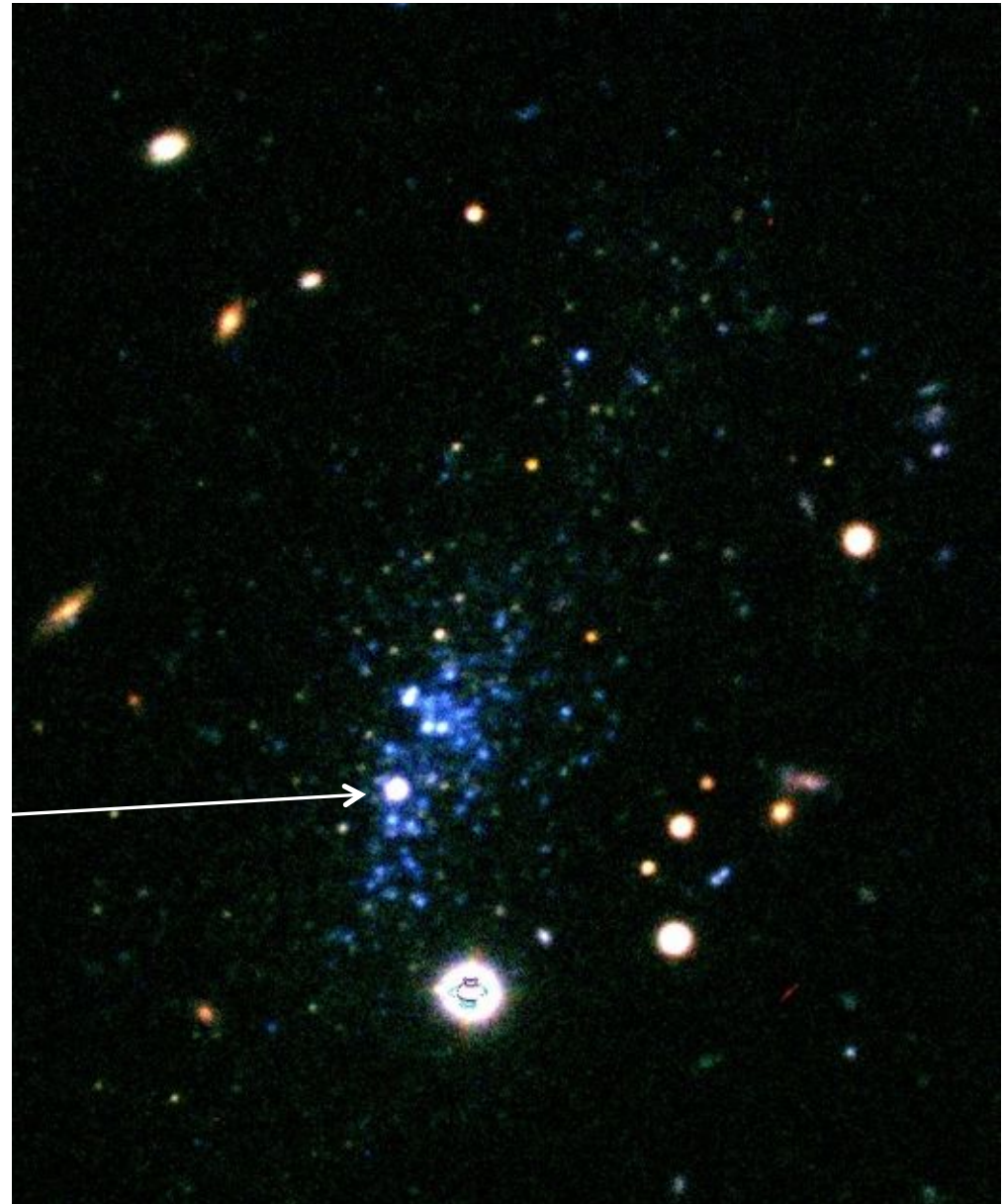
Discovered early February by Riccardo Giovanelli in the ALFALFA project Arecibo observations. (Giovanelli et al. submitted)

A New Dwarf Galaxy in the Local Group?



A New Dwarf Galaxy in the Local Group?

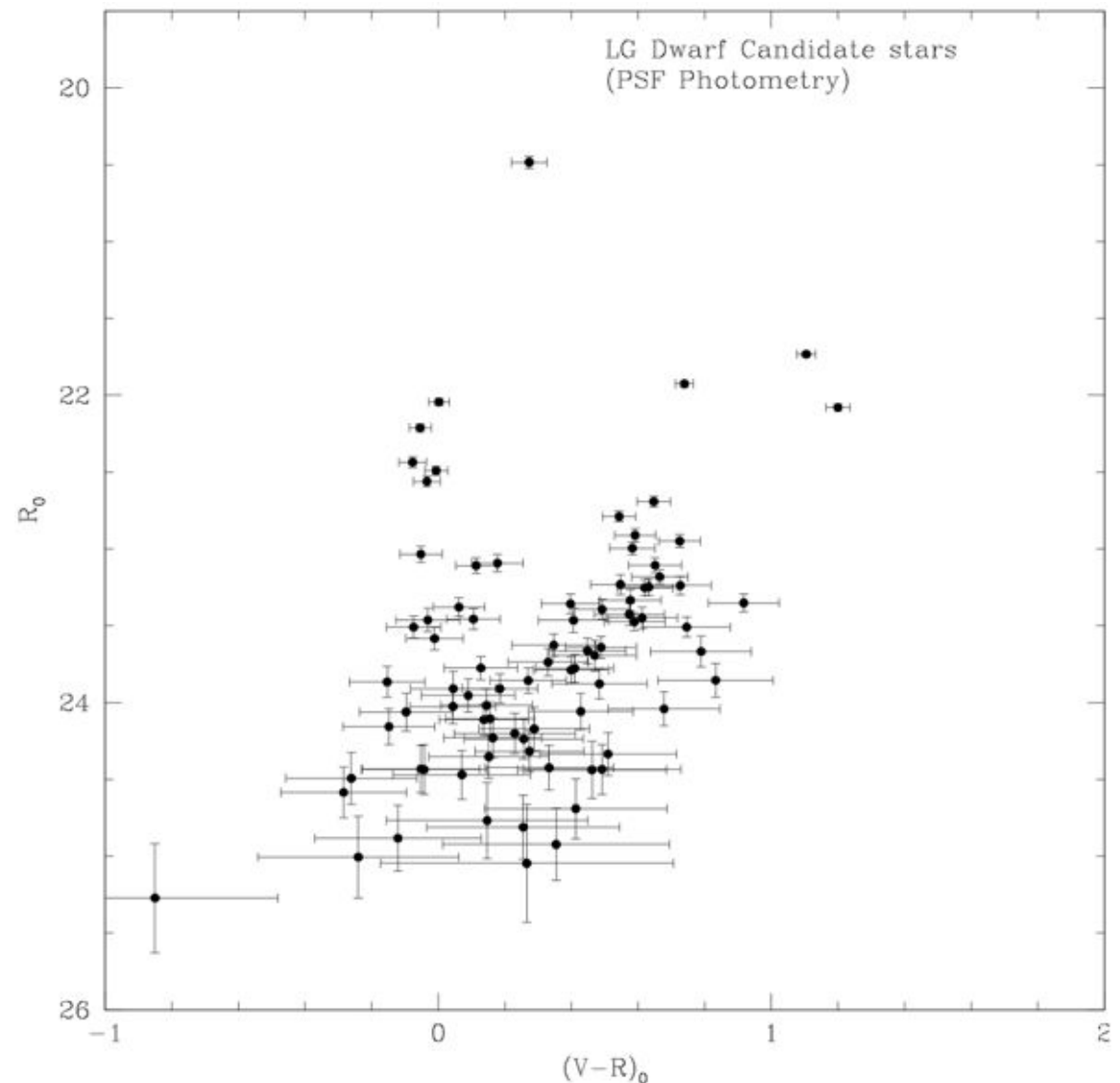
- WIYN 3.5m images obtained in late March (K. Rhode et. al submitted)
- Highly resolved stellar population



A New Dwarf Galaxy in the Local Group?

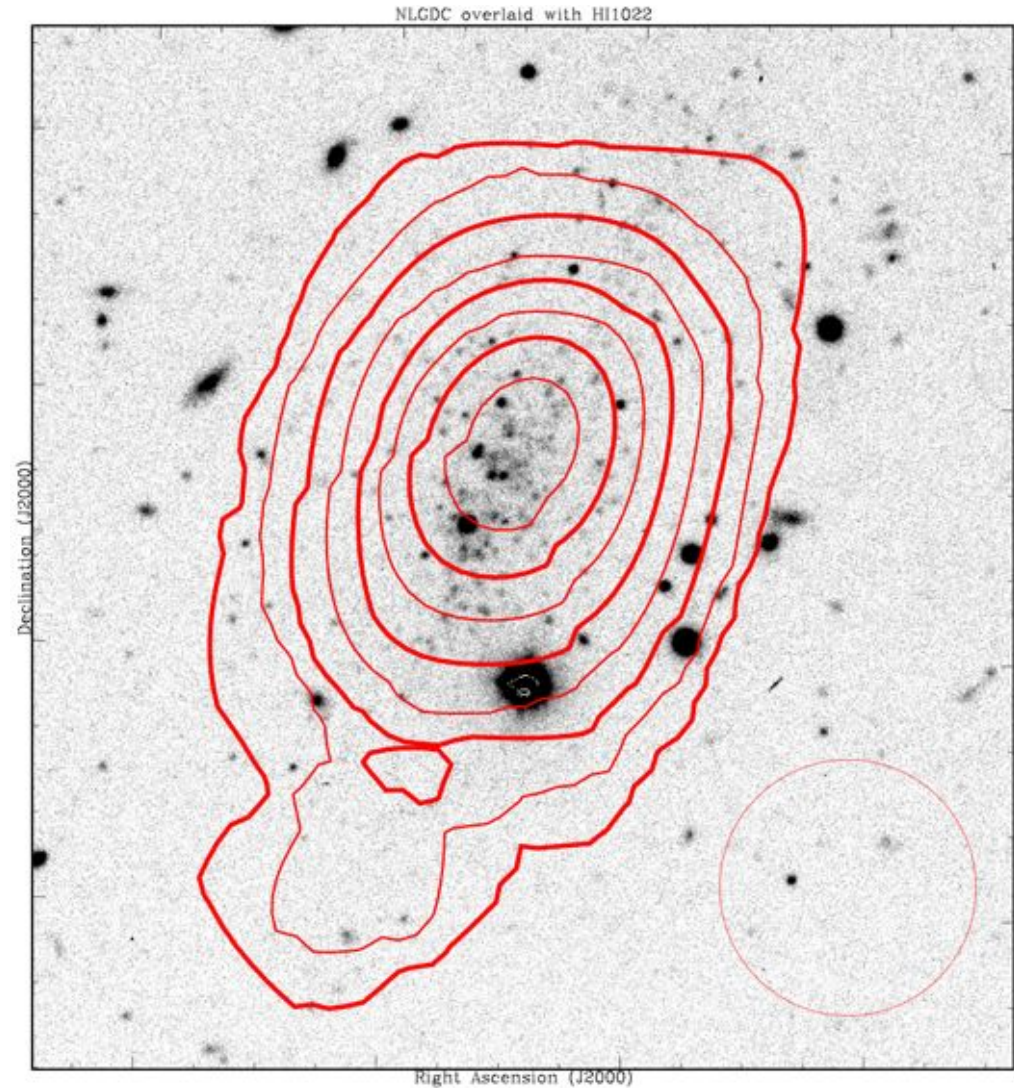
$$D = 400 \pm 140 \text{ kpc}$$

- WIYN 3.5m CMD
- Sparse RGB
- Well populated MS
- Δm between two brightest stars gives coarse distance estimate



A New Dwarf Galaxy in the Local Group?

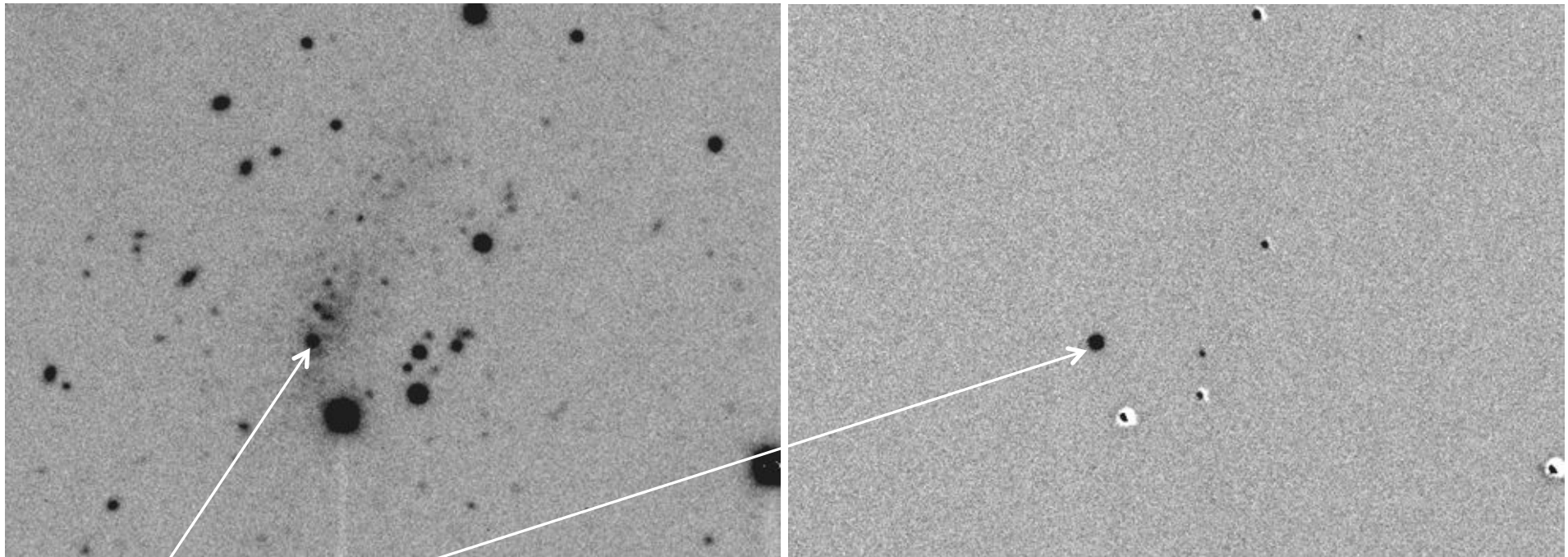
- EVLA DDT imaging acquired April 18
(Cannon et al. in prep)



A New Dwarf Galaxy in the Local Group?

R-band

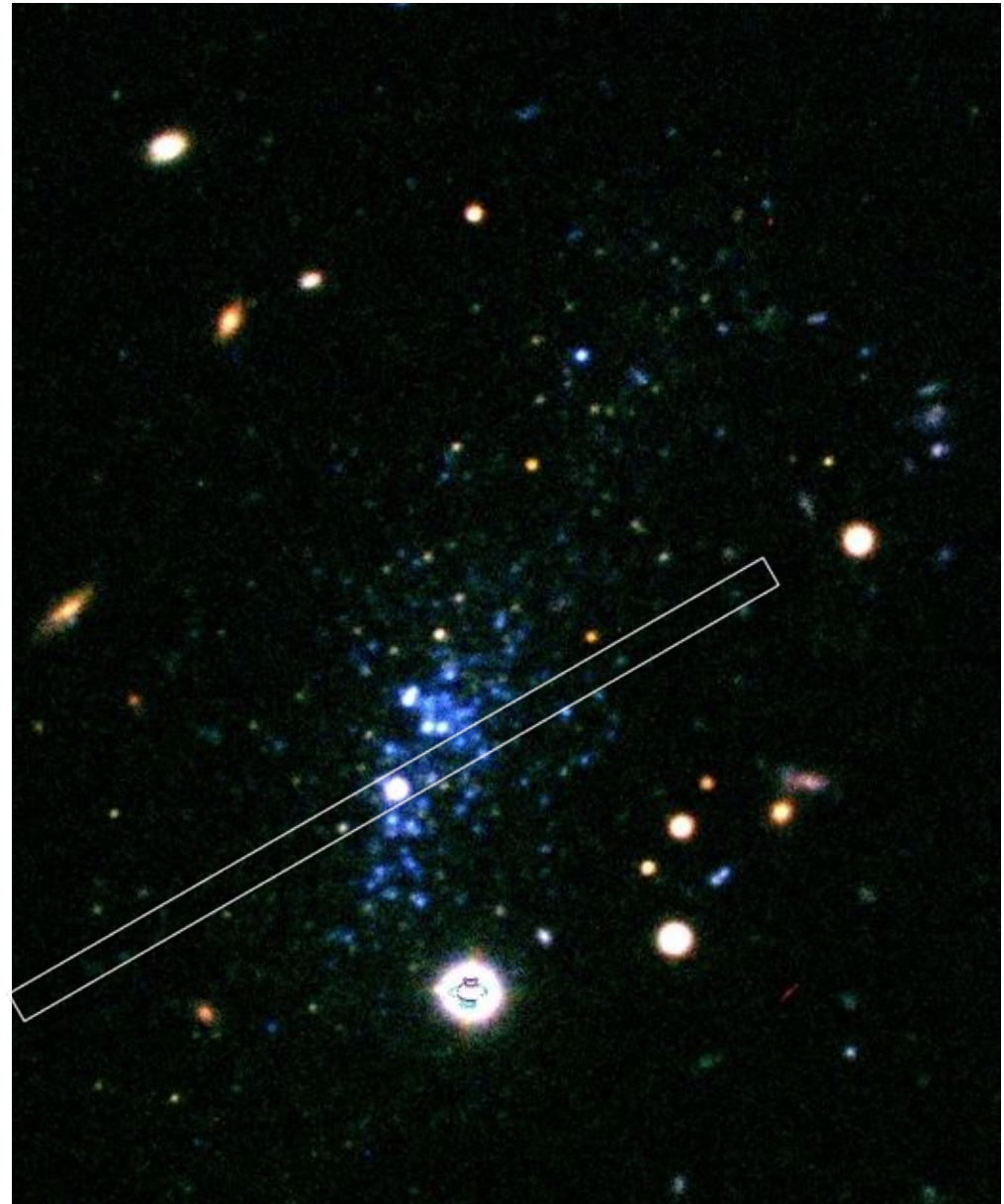
H α



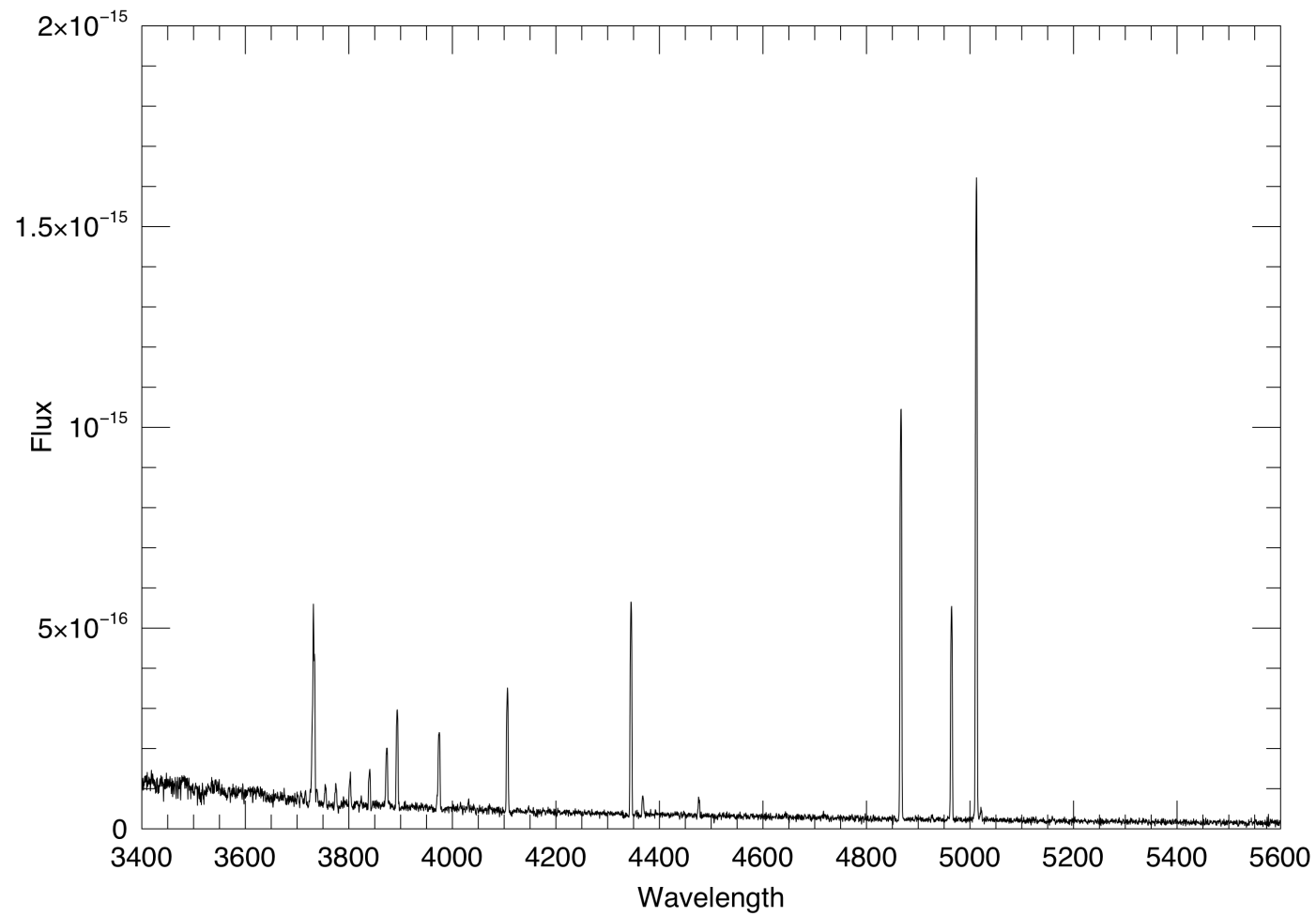
Single brightest star excites compact HII region

A New Dwarf Galaxy in the Local Group?

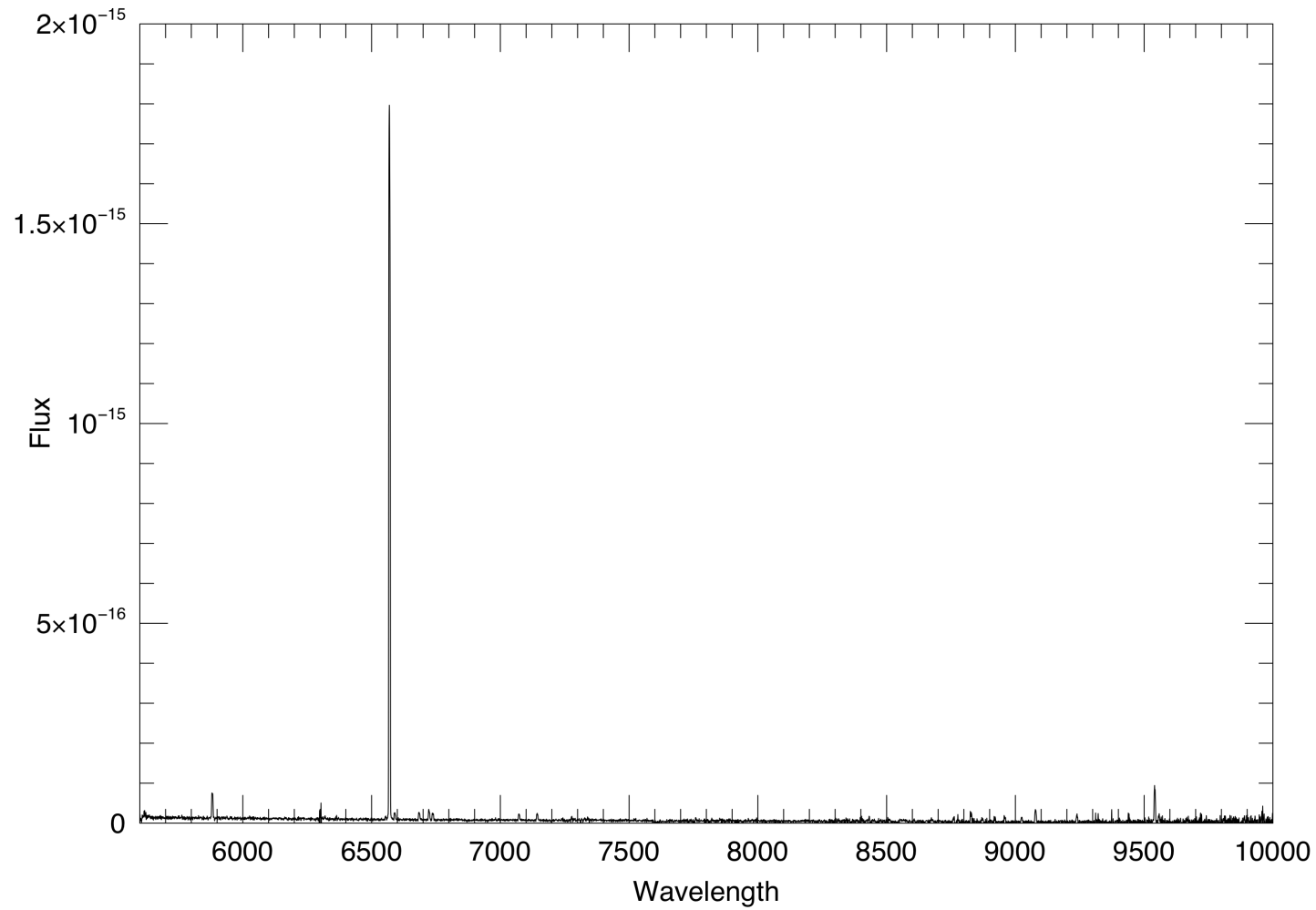
- LBT/MODS spectrum obtained April 28



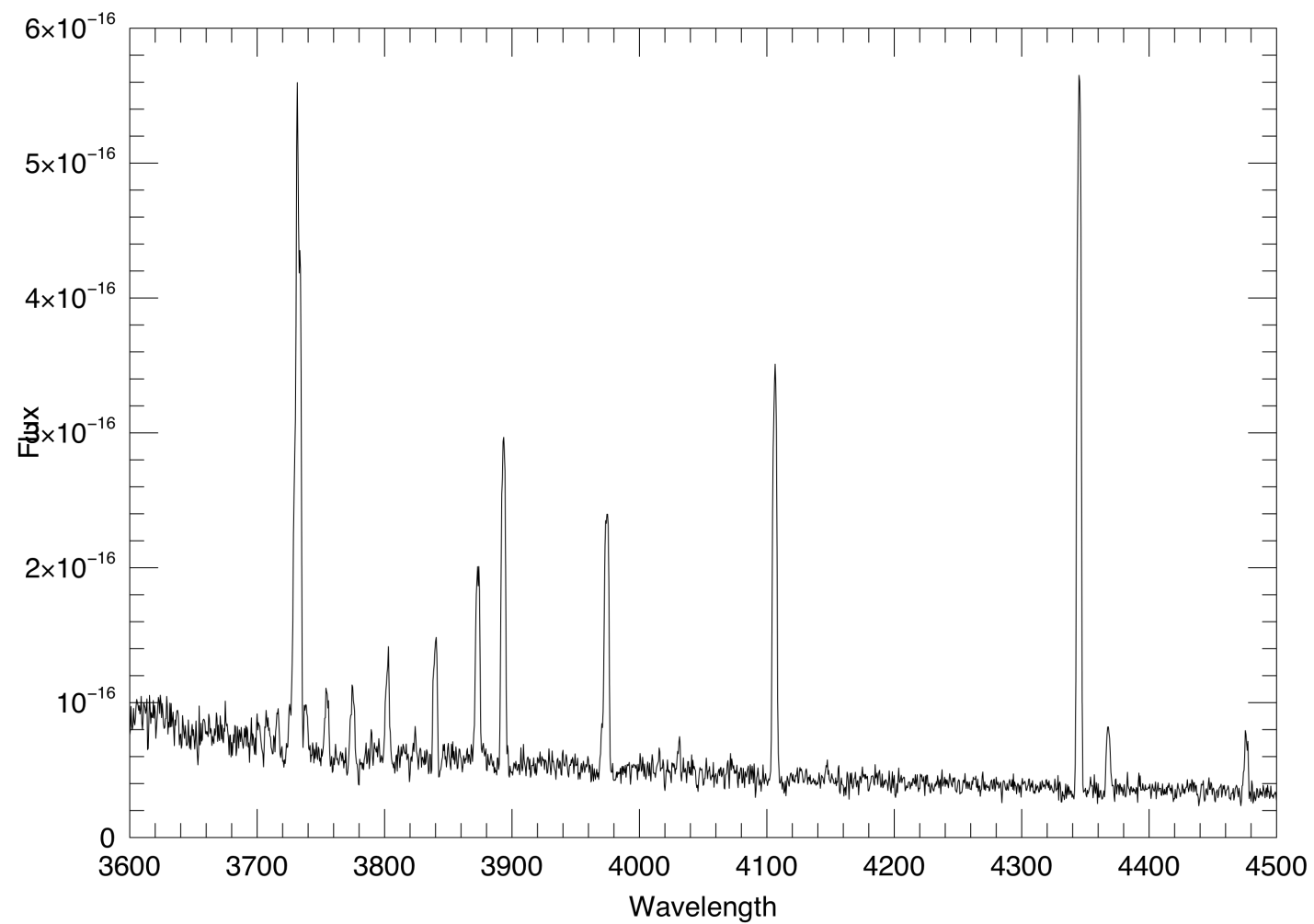
A New Dwarf Galaxy in the Local Group?

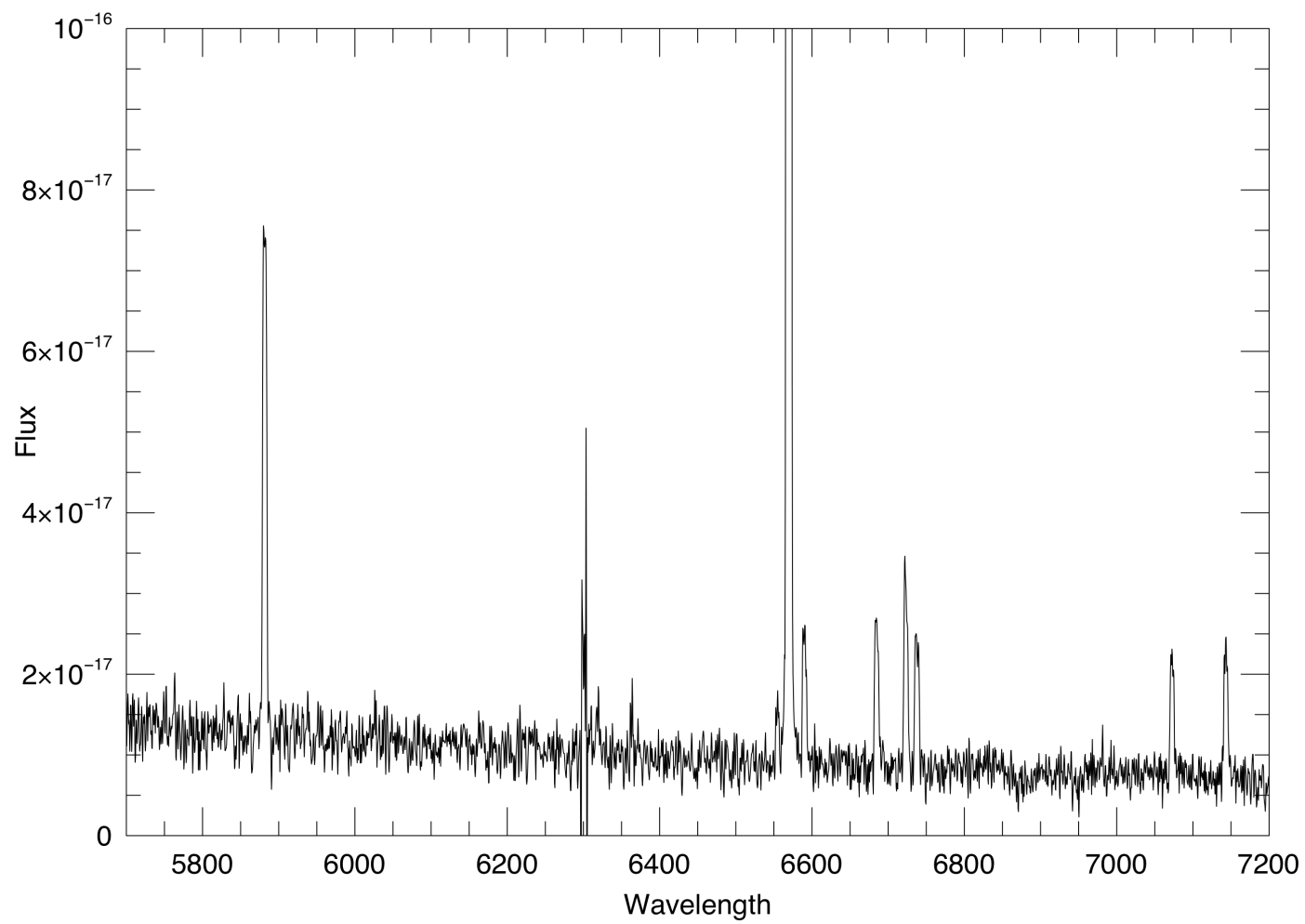


A New Dwarf Galaxy in the Local Group?



LBT/MODS 3 x 15 minutes





- Candidate appears to be in the Local Group
- At 400 kpc, $M(V) = -6.1$,
- Nebular spectrum favors a very metal poor ISM
- New EVLA images show gas extended beyond 30". Very narrow HI line width.
- Nebular spectrum will allow accurate He/H measurement relevant to primordial helium determination

- One of the primary goals of ALFALFA is to detect gas-bearing mini-halos
- This system offers strong support for a population of gas-rich, low surface brightness, as yet undiscovered galaxies in the Local Group
- Other candidates exist in this class; a battery of follow up observations is required
- Other ALFALFA work in progress expands parameter space (e.g., Betsey Adams PhD thesis)

Conclusions

I am very excited about the CHAOS project.

I'm also very excited about the new dwarf galaxy.

Thanks for your comments and suggestions.