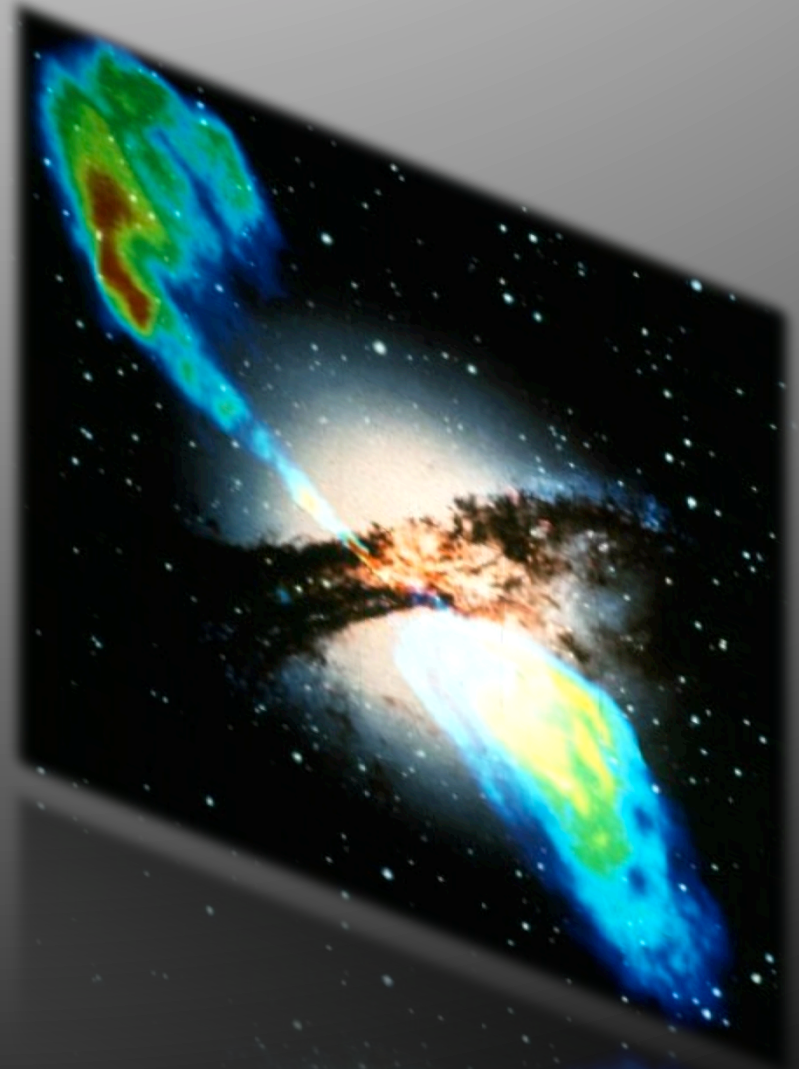


Black Hole Emission in the Nearby Universe

Scott Fix

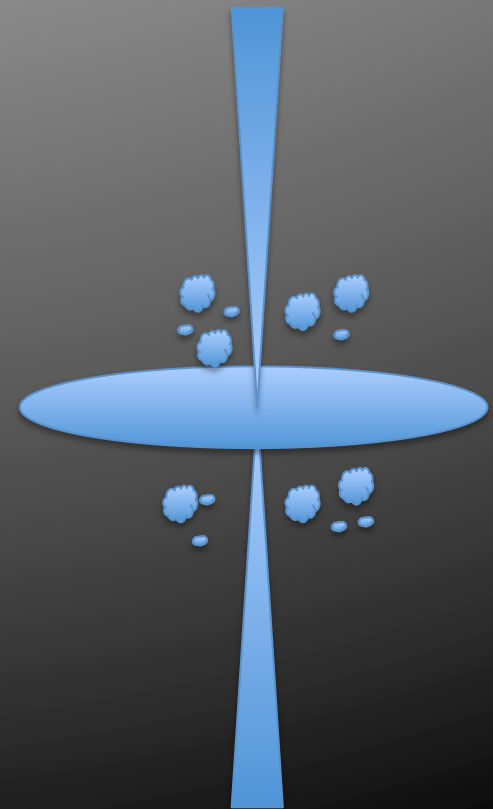
Research Assistant

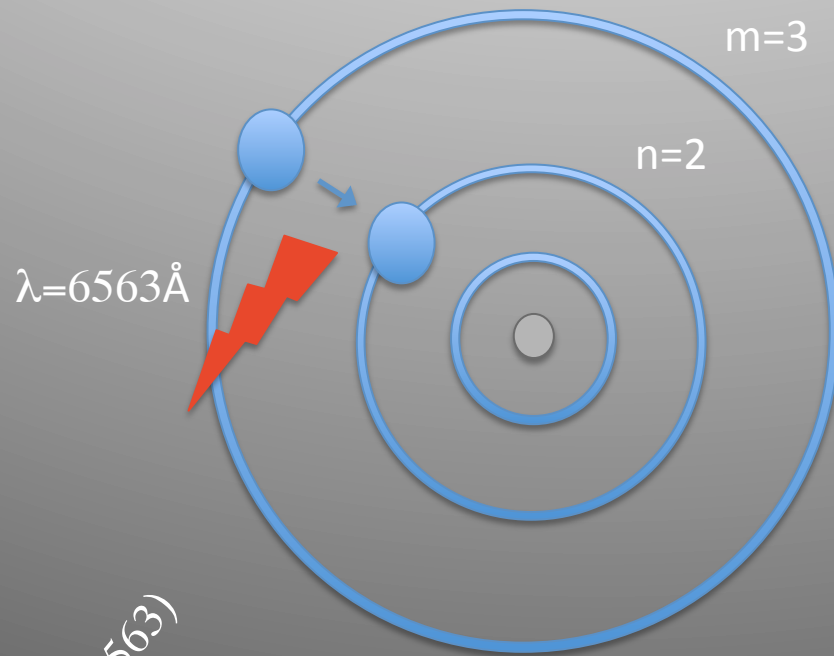
James Madison University



At a Glance ...

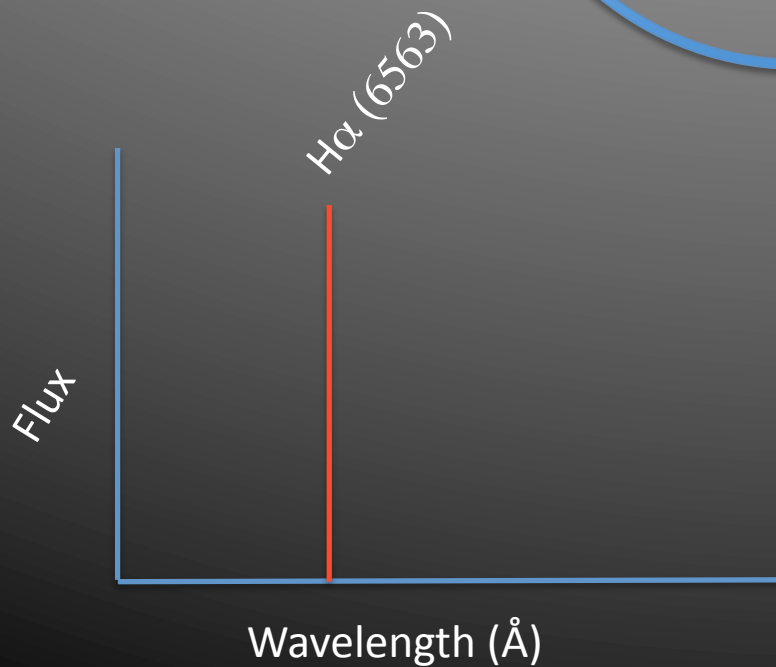
- Motivation
 - Review of Emission Lines
 - Primer on Active Galactic Nuclei
 - Direction of Project
- Data Reduction
- Revealing the Broad Line





Balmer Series

$$\lambda = B * (m^2 / m^2 - n^2)$$



Relevant Emission Lines (Å)

H α = 6563

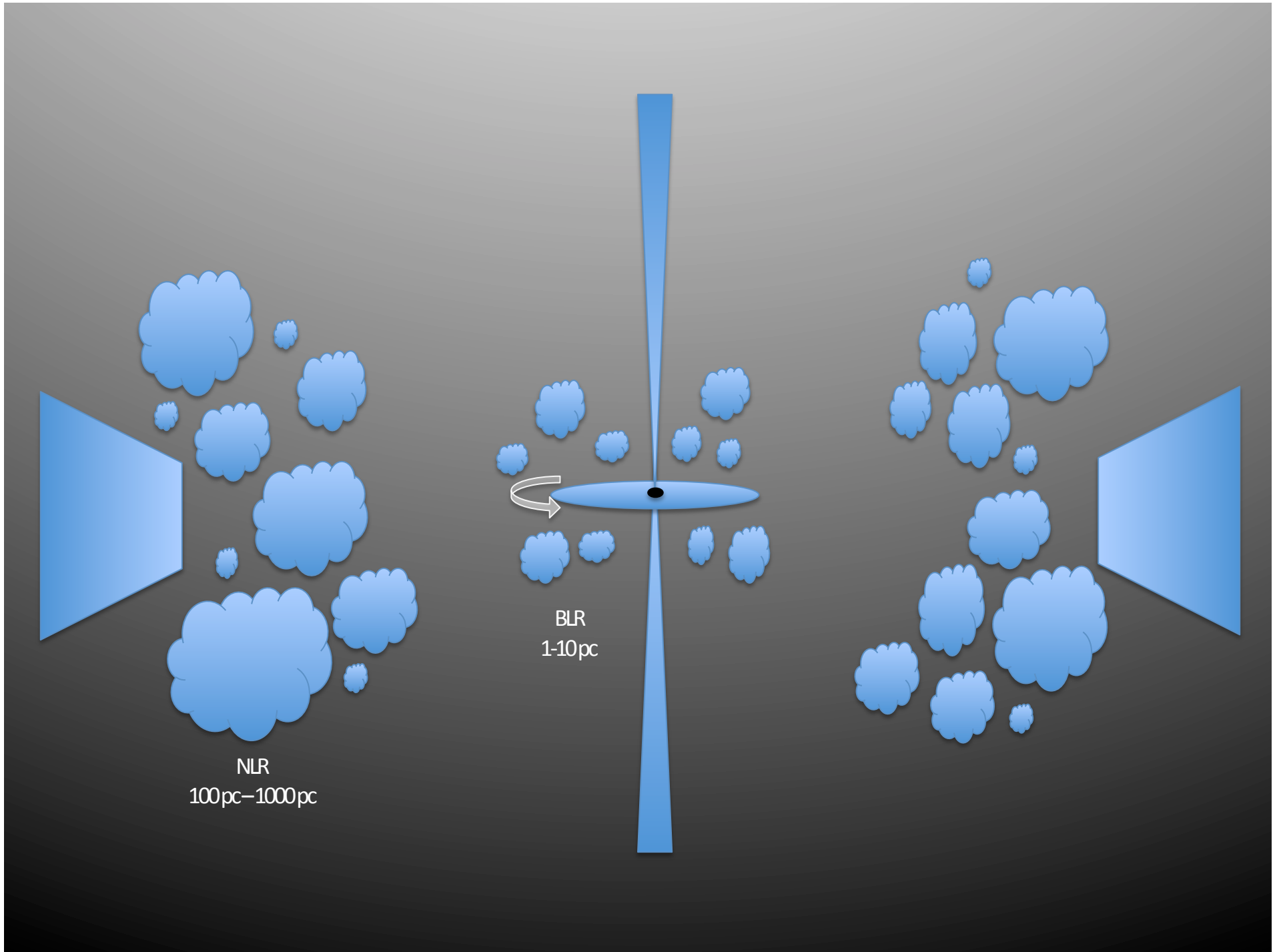
H β = 4861

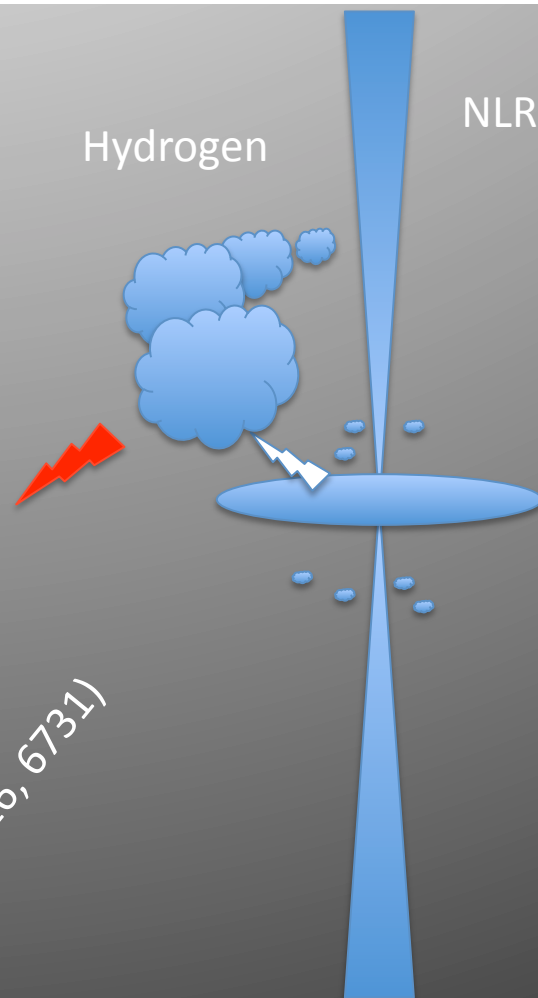
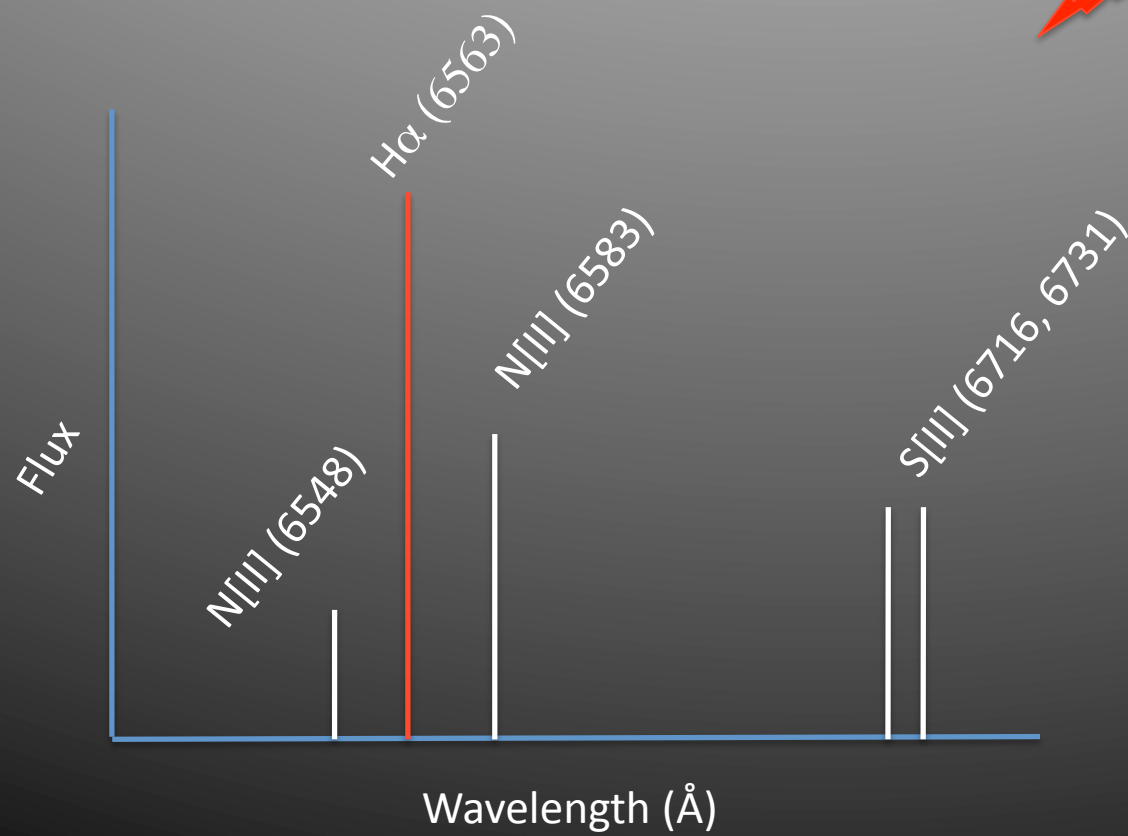
N[II] = 6548, 6583

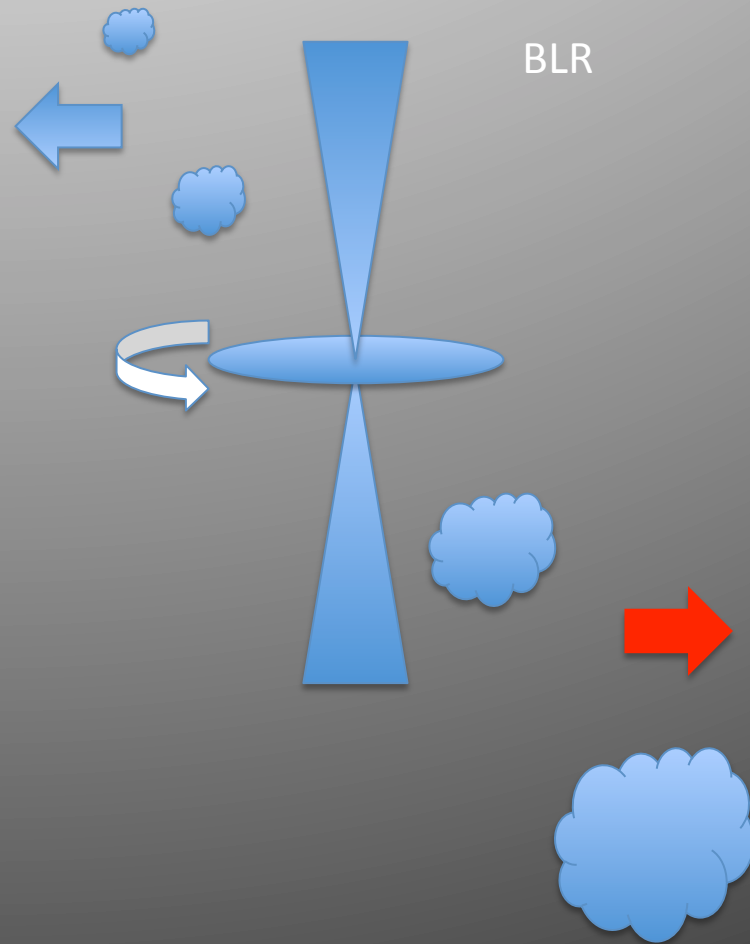
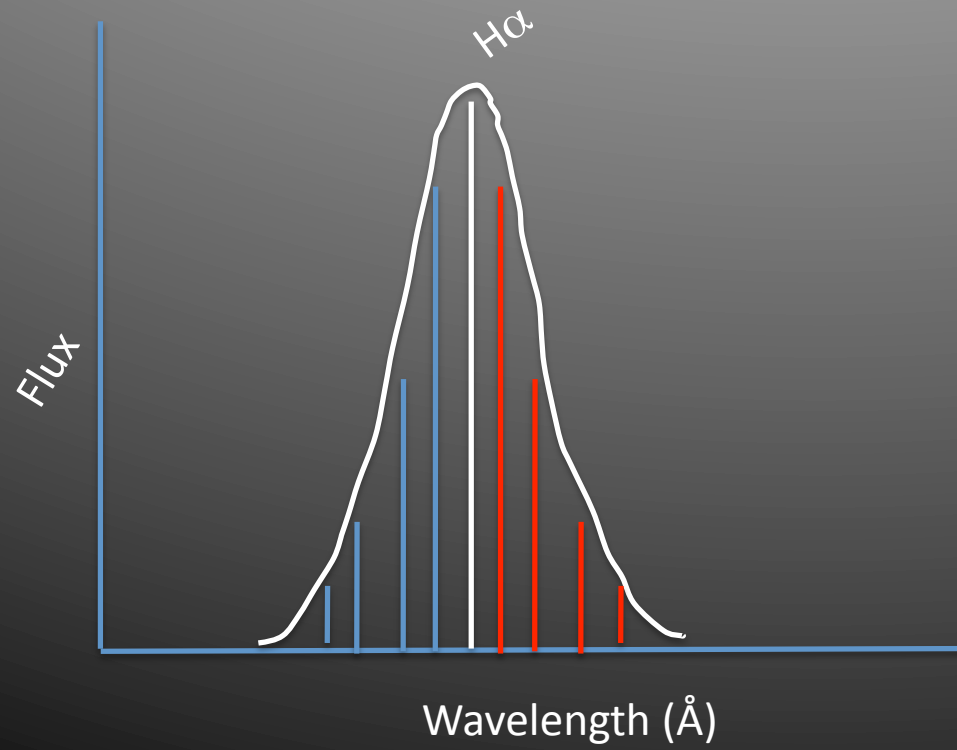
S[II] = 6716, 6731

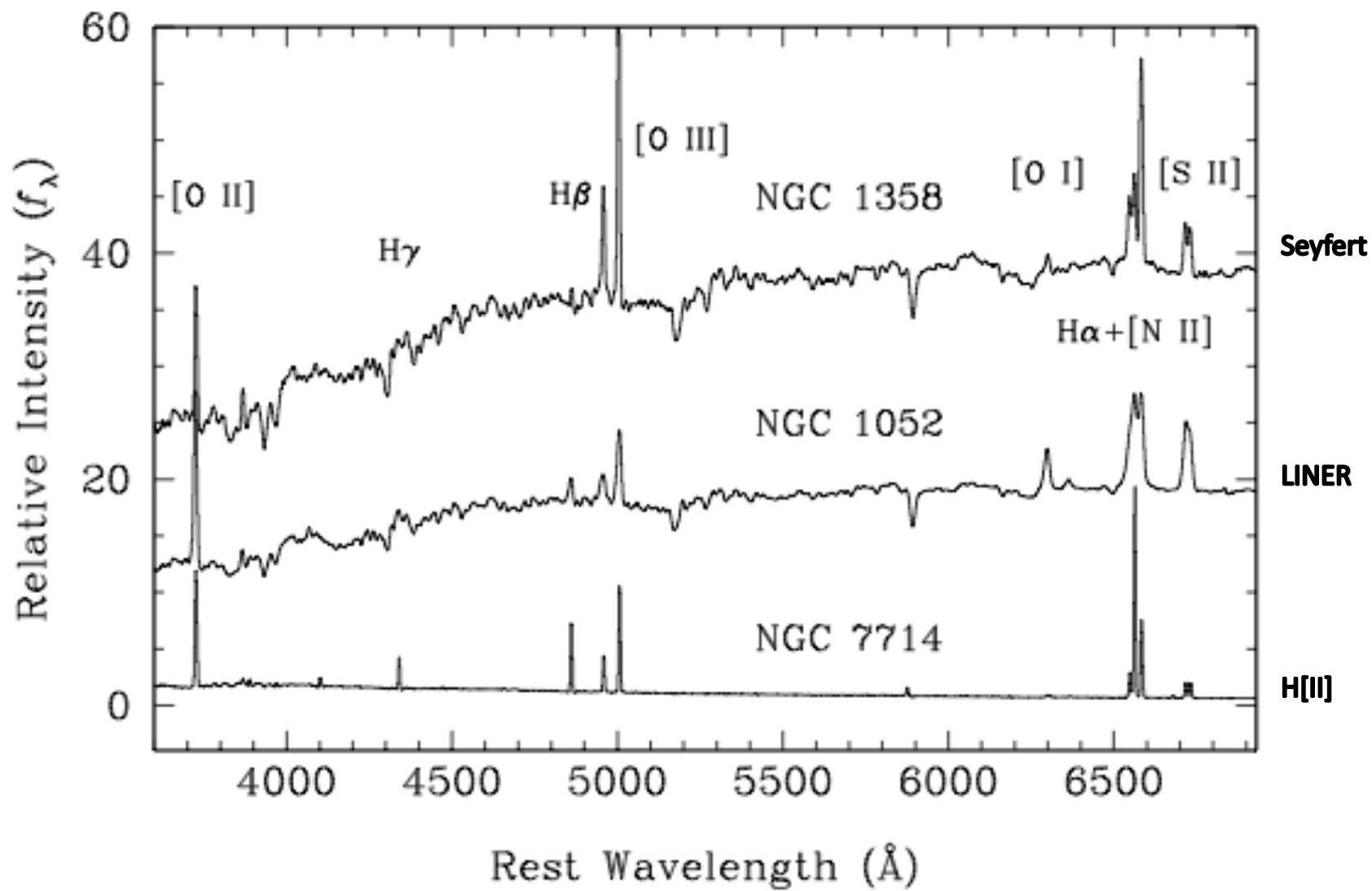
O[I] = 6300

O[III] = 4959, 5007

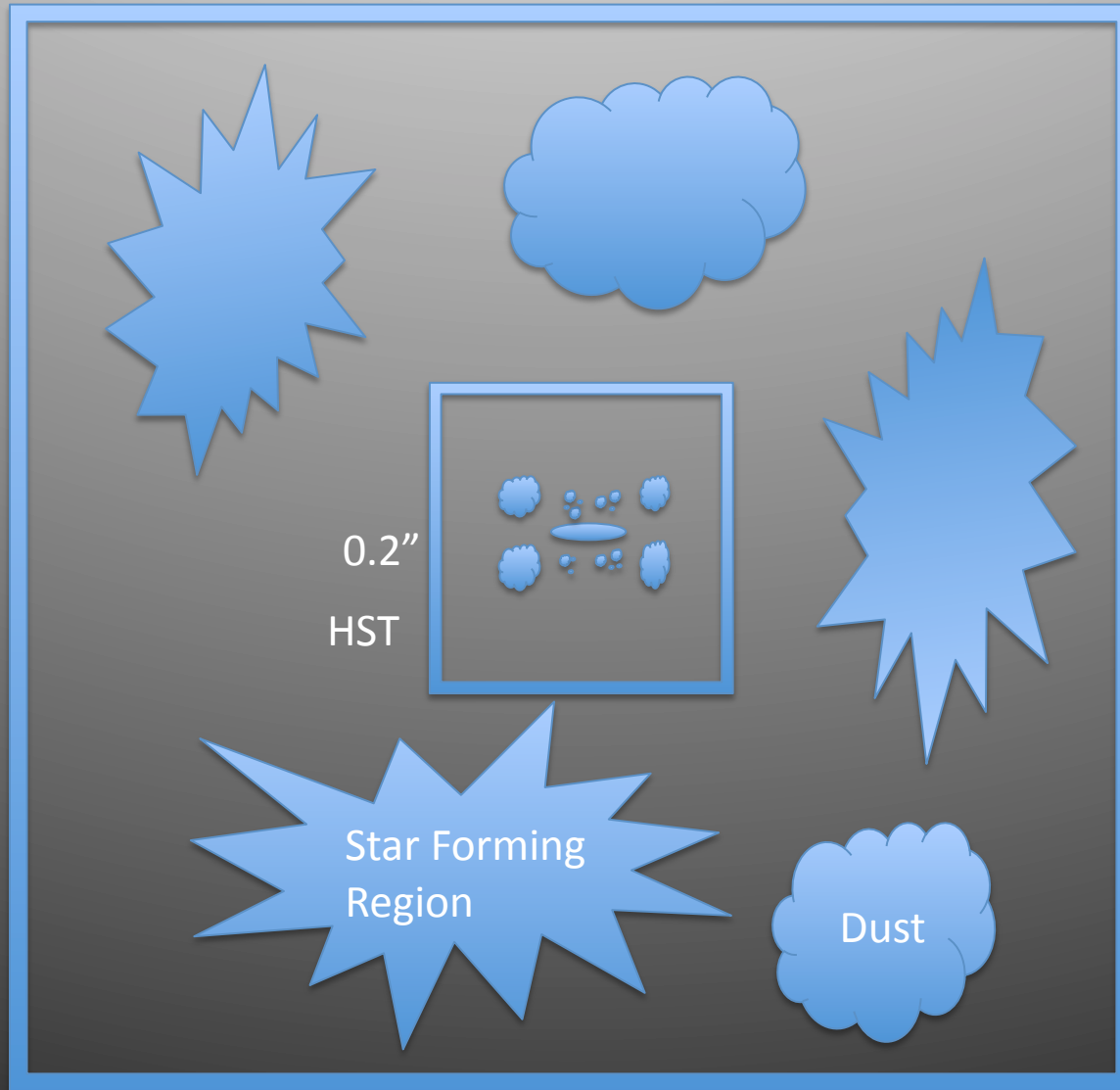






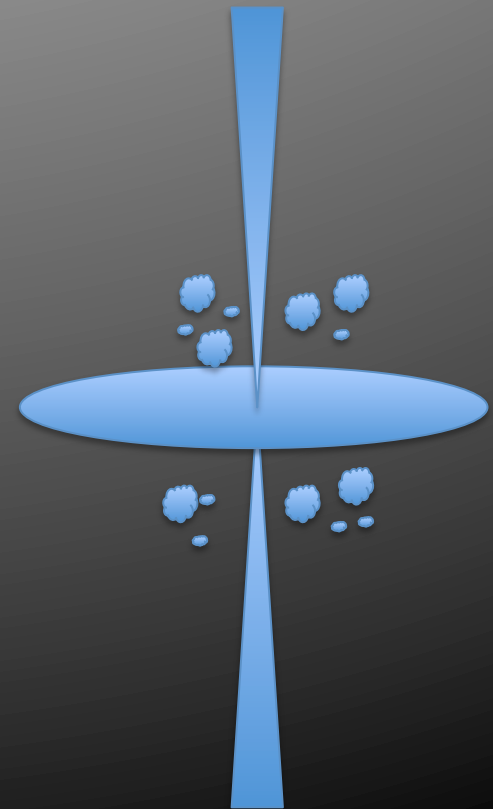


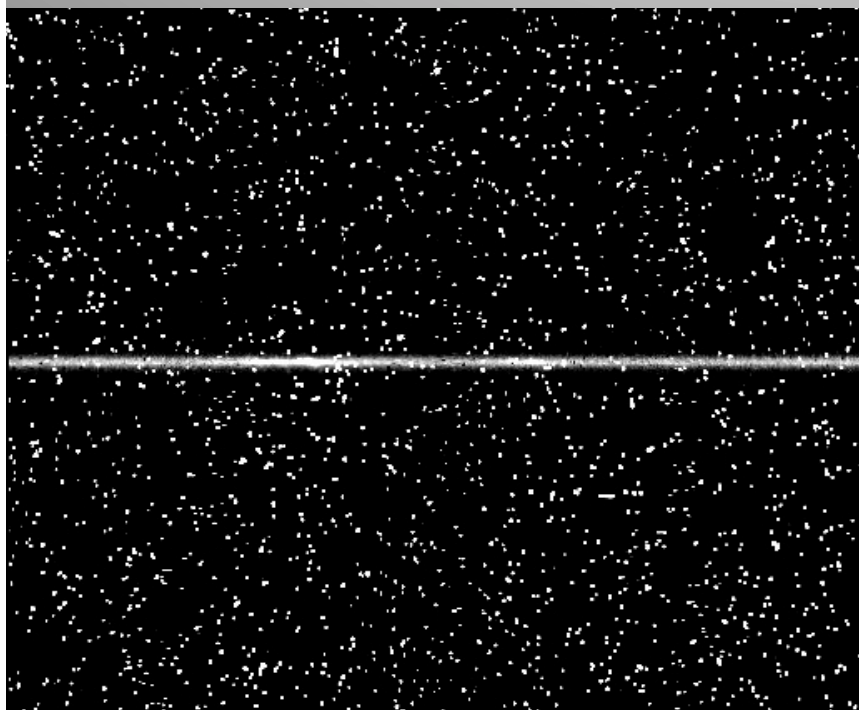
2"
Ground
Based



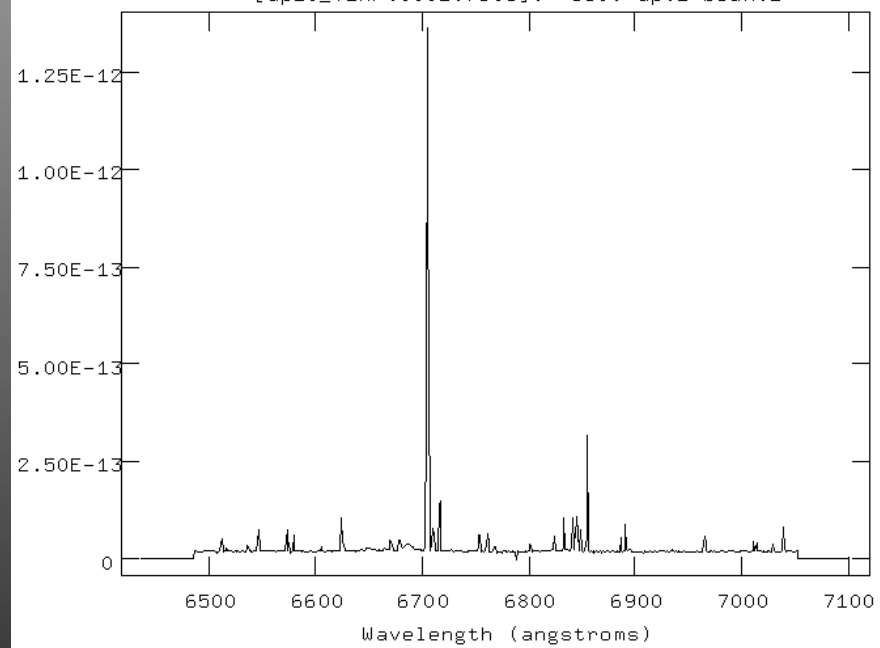
At a Glance ...

- Motivation
- Data Reduction
 - Extraction
 - Cosmic Ray Removal
 - Corrections
- Revealing the Broad Line

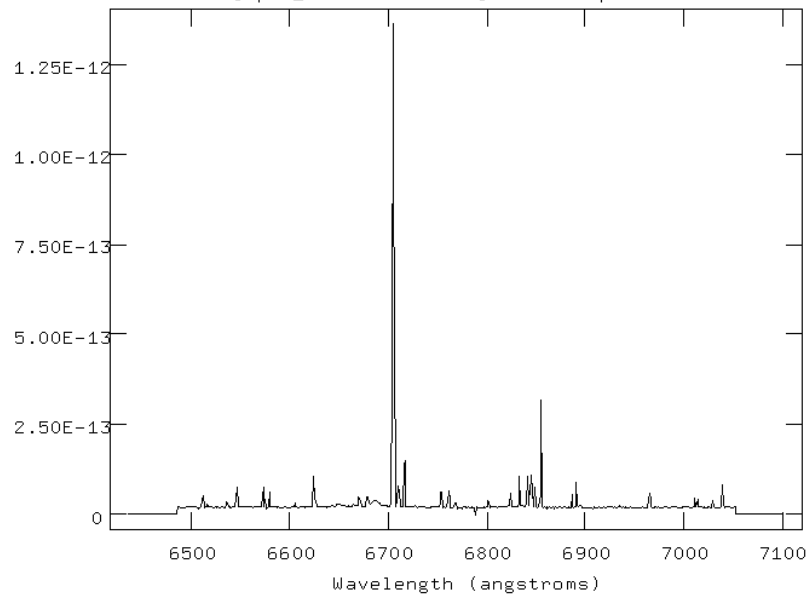




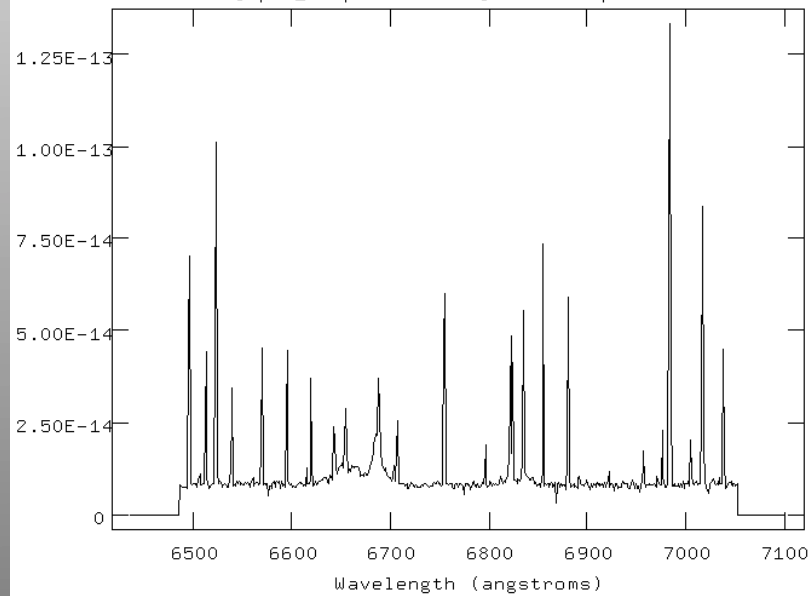
NOAO/IRAF V2.14EXPORT fixts@messier.local Sun 11:00:53 21-Mar-2010
[ap10_TEMP.0001.fits]: 650. ap:1 beam:1



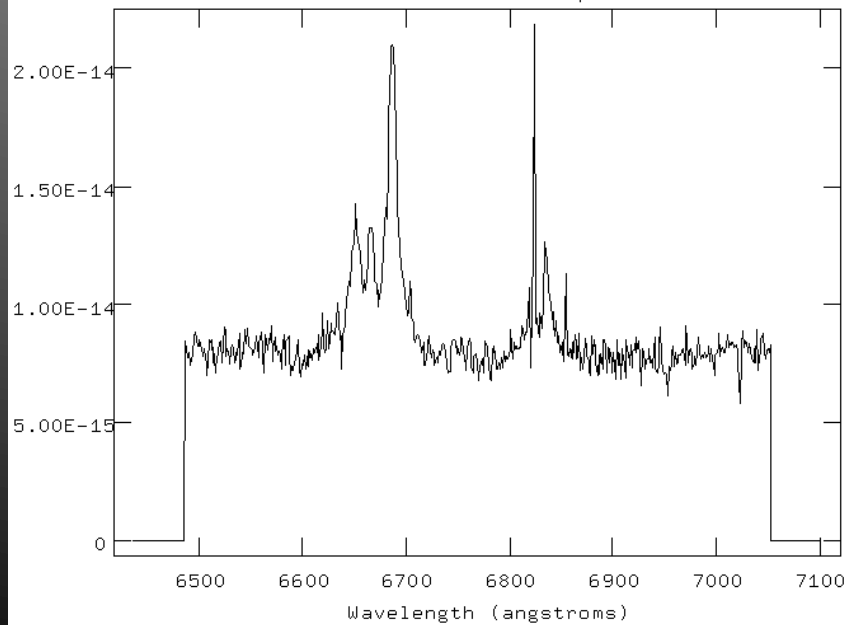
NOAO/IRAF V2.14EXPORT fixts@messier.local Sun 11:00:53 21-Mar-2010
[ap10_TEMP.0001.fits]: 650. ap:1 beam:1



NOAO/IRAF V2.14EXPORT fixts@messier.local Sun 11:05:48 21-Mar-2010
[ap20_temp.0001.fits]: 650. ap:1 beam:1

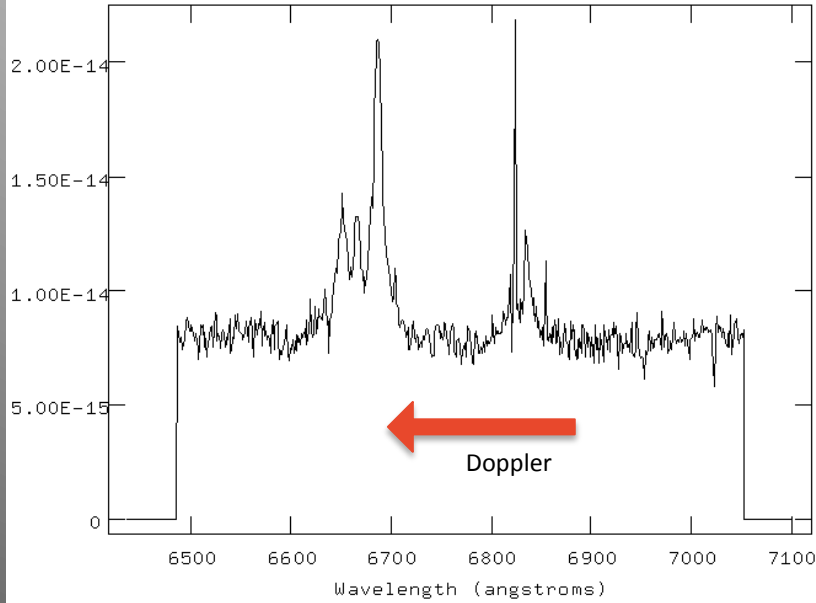


NOAO/IRAF V2.14EXPORT fixts@messier.local Sun 11:10:19 21-Mar-2010
[cr_1020.fits]: 650. ap:1 beam:1



NDAO/IRAF V2.14EXPORT fixts@messier.local Sun 11:10:19 21-Mar-2010
[cr_1020.fits]: 650. ap:1 beam:1

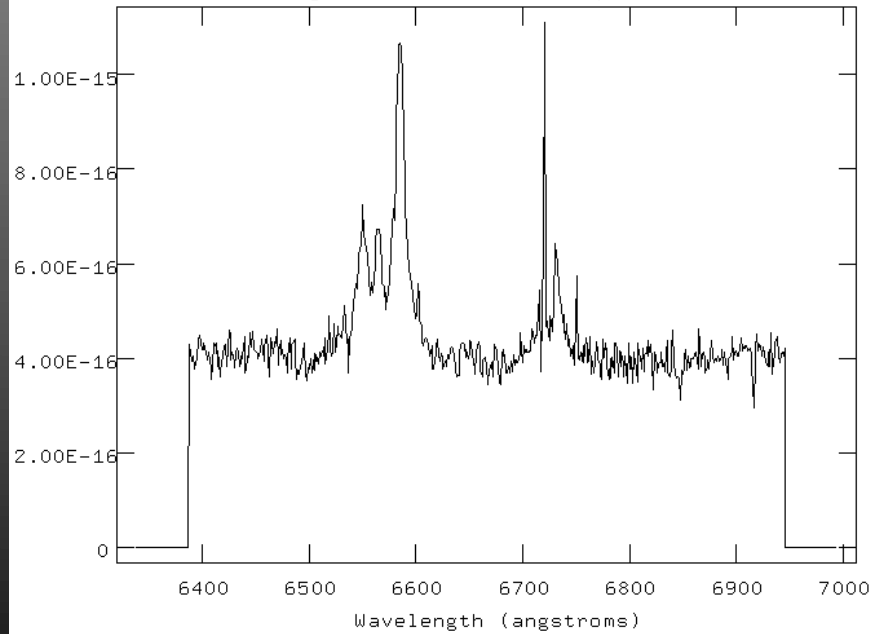
Brightness



$$\text{Brightness} = \text{Flux} / \text{Area}$$

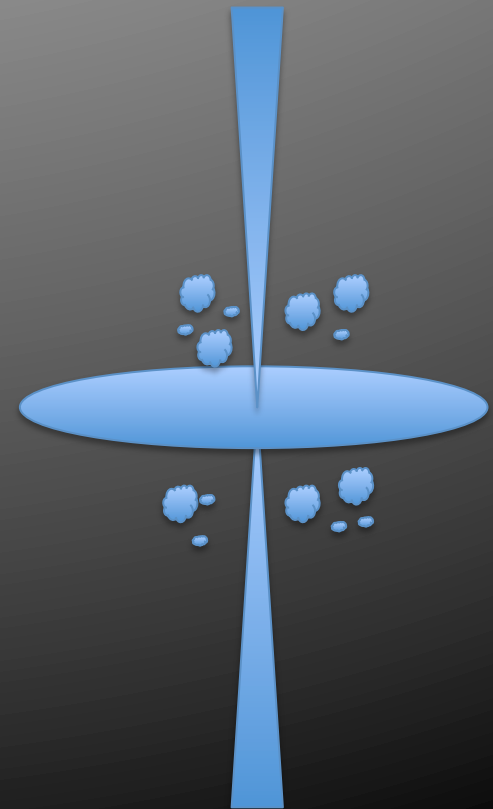
Flux

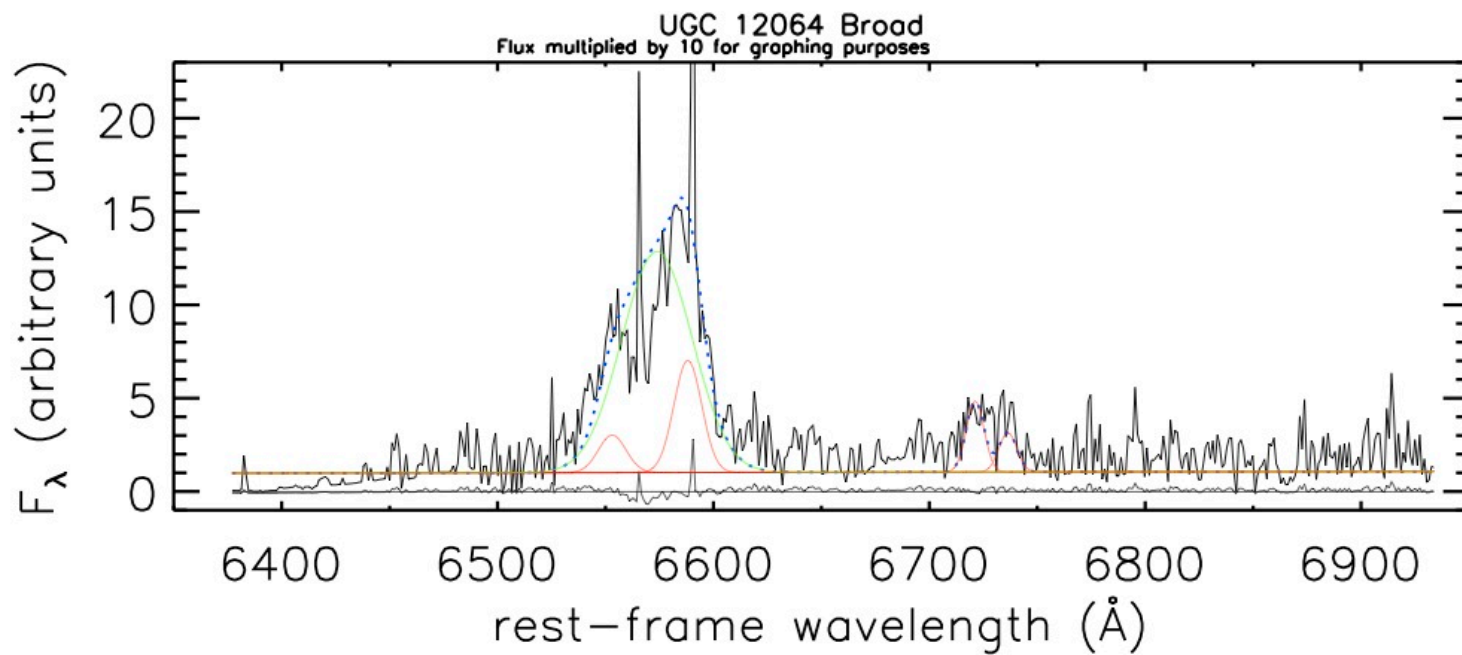
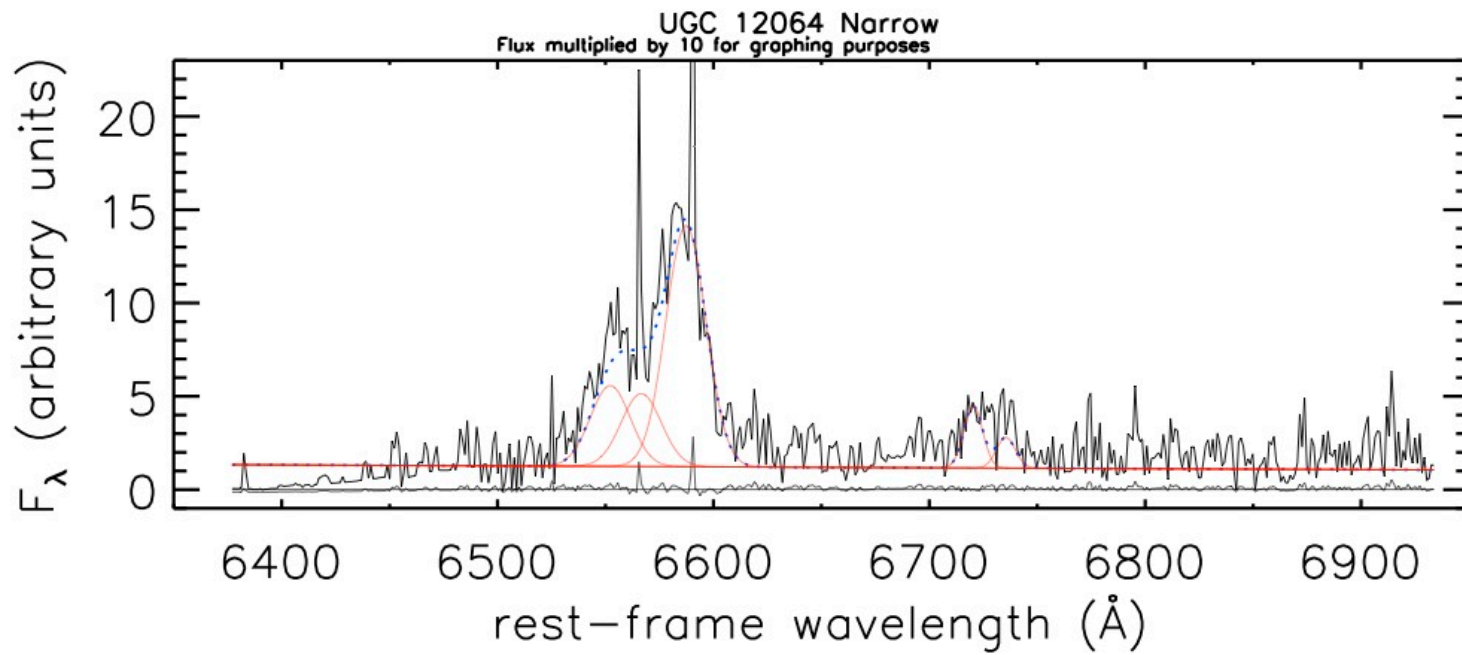
NDAO/IRAF V2.14EXPORT fixts@messier.local Sun 11:17:21 21-Mar-2010
[ngc4335_d.imh]: 650. ap:1 beam:1

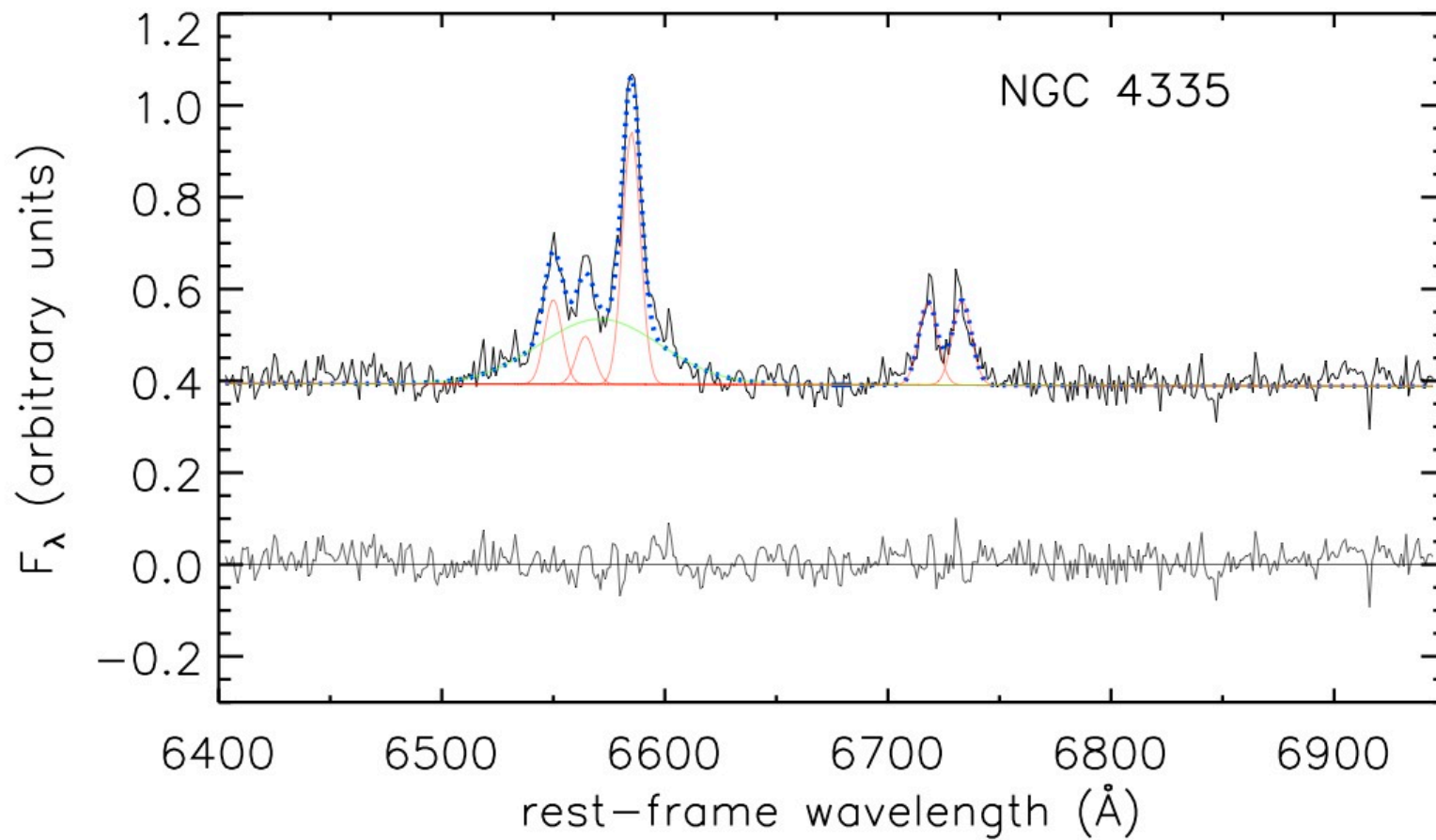


At a Glance ...

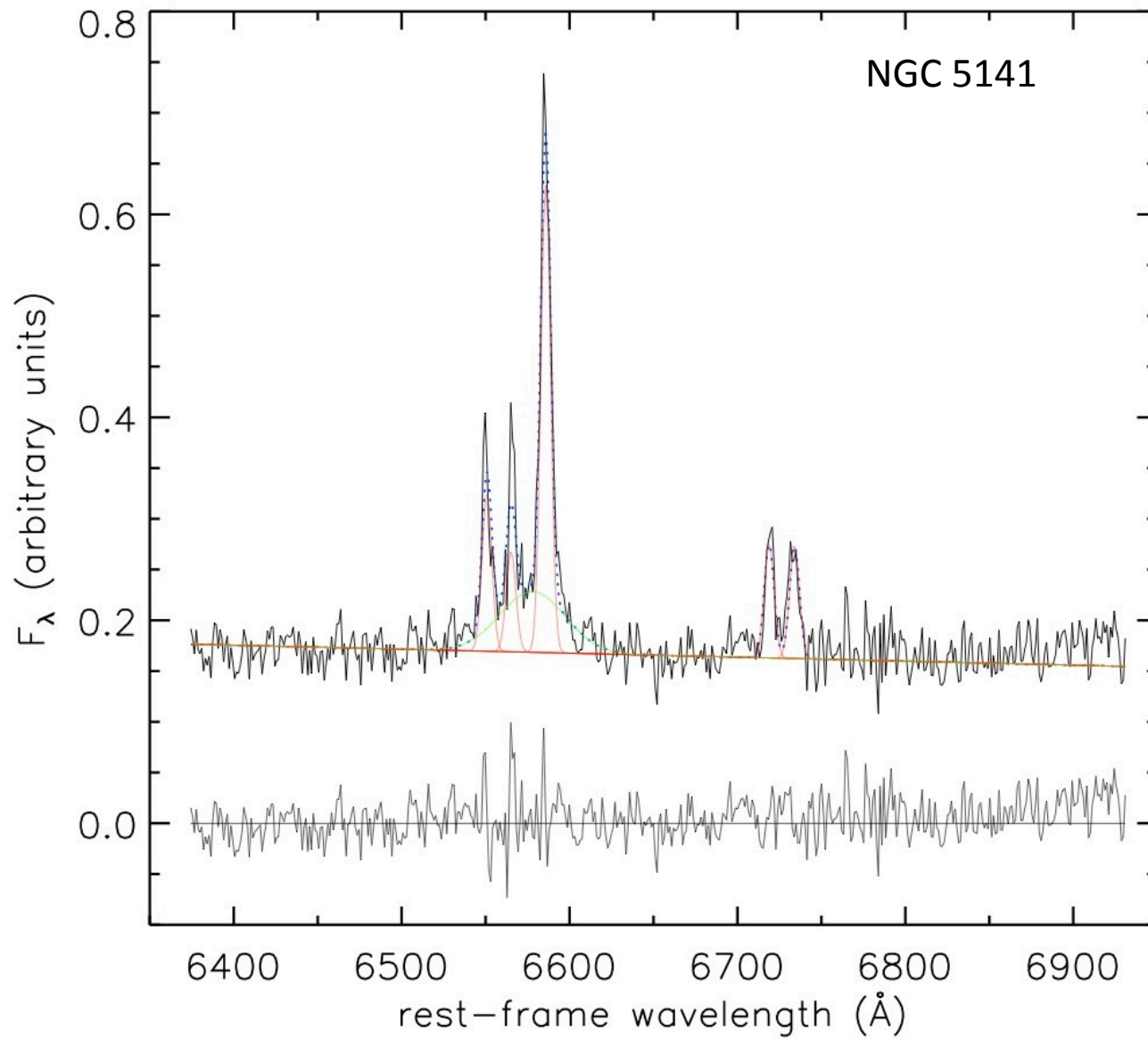
- Motivation
- Data Reduction
- Revealing the Broad Line
 - Fits
 - Future Work







Galaxy	χ^2 (Fit)	FWHM (Narrow)	FWHM (broad)	Error
NGC4335**	0.7456276	426.52777	2920.2507	153.63



Galaxy	χ^2 (Fit)	FWHM (Narrow)	FWHM (broad)	Error
NGC5141	2.288524	310.41769	2086.1514	1137.4

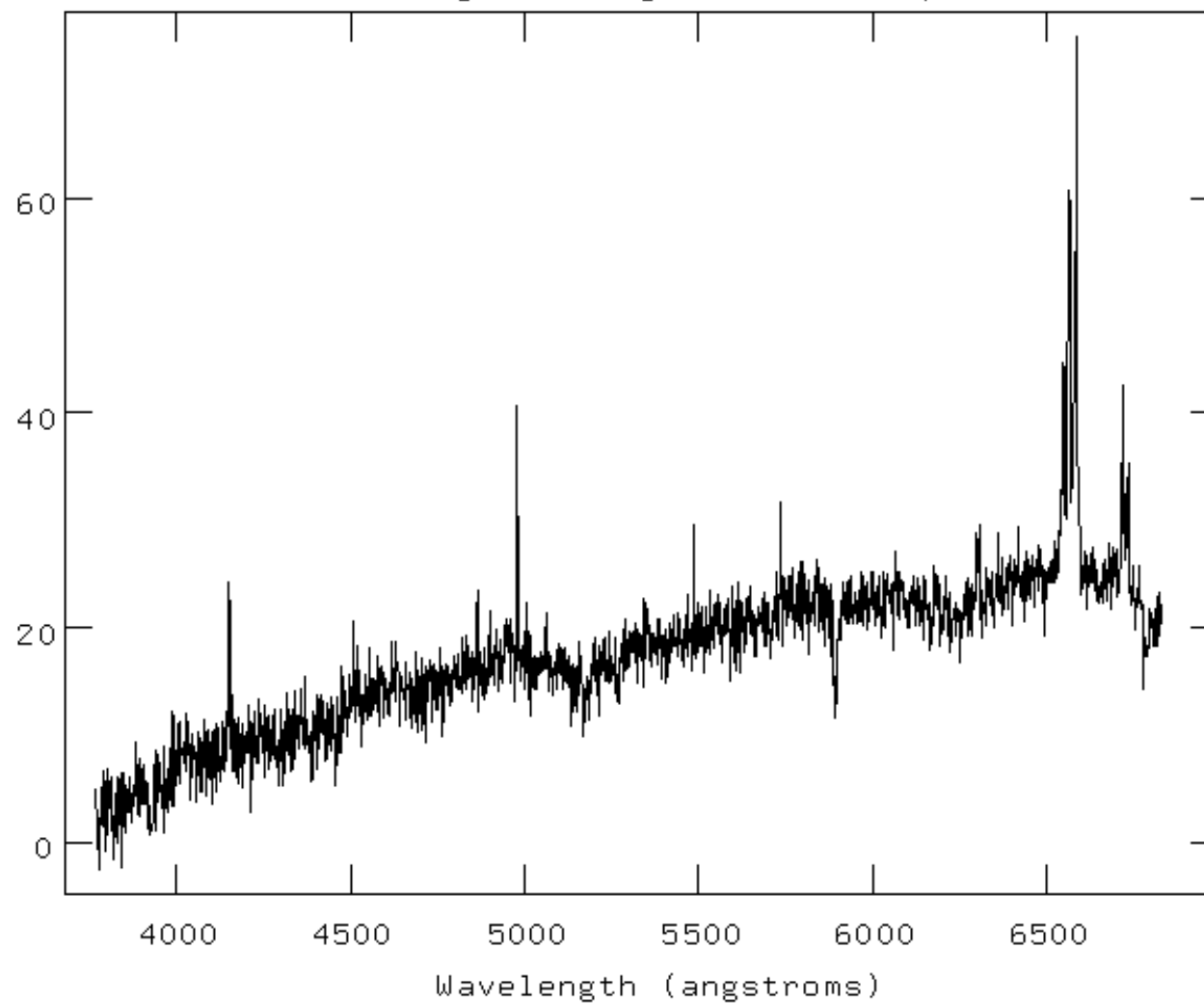
Galaxy	χ^2 (Fit)	FWHM (Narrow)	FWHM (broad)	Error
NGC4335**	0.7456276	426.52777	2920.2507	153.63
NGC3862	1.57279	588.63574	2564.2517	432.95
UGC7115	1.878485	884.31287	4230.9609	1275.8
NGC5490	2.169388	550.88312	3086.2129	217.06
NGC5141	2.288524	310.41769	2086.1514	1137.4
NGC1497**	18.55919	485.98798	1864.7147	320.6
NGC193*	34.49802	862.34741	8699.9443	927.78
UGC01841*	65.34447	1233.4331	3423.709	243.79

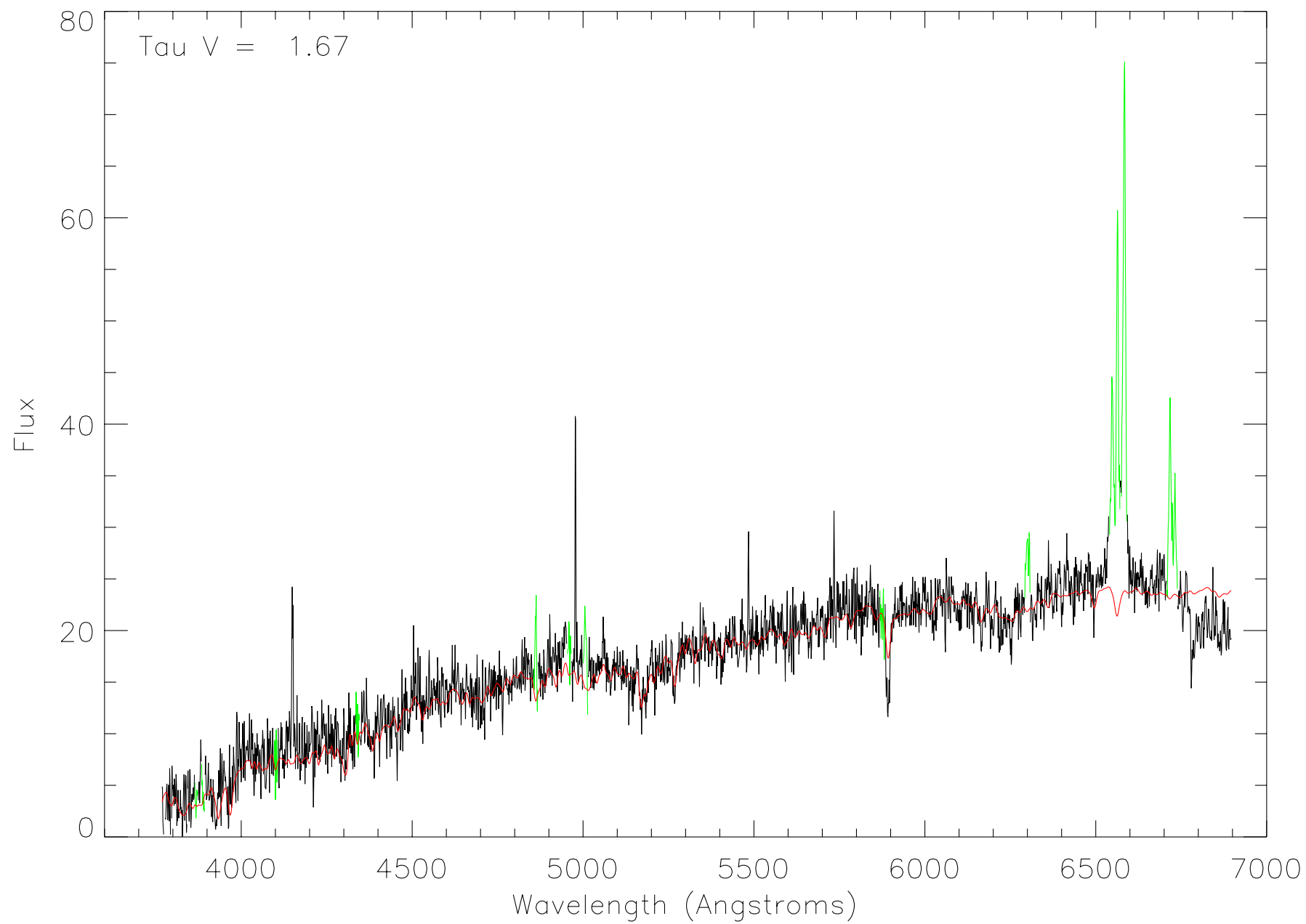
8 detections of broad H α

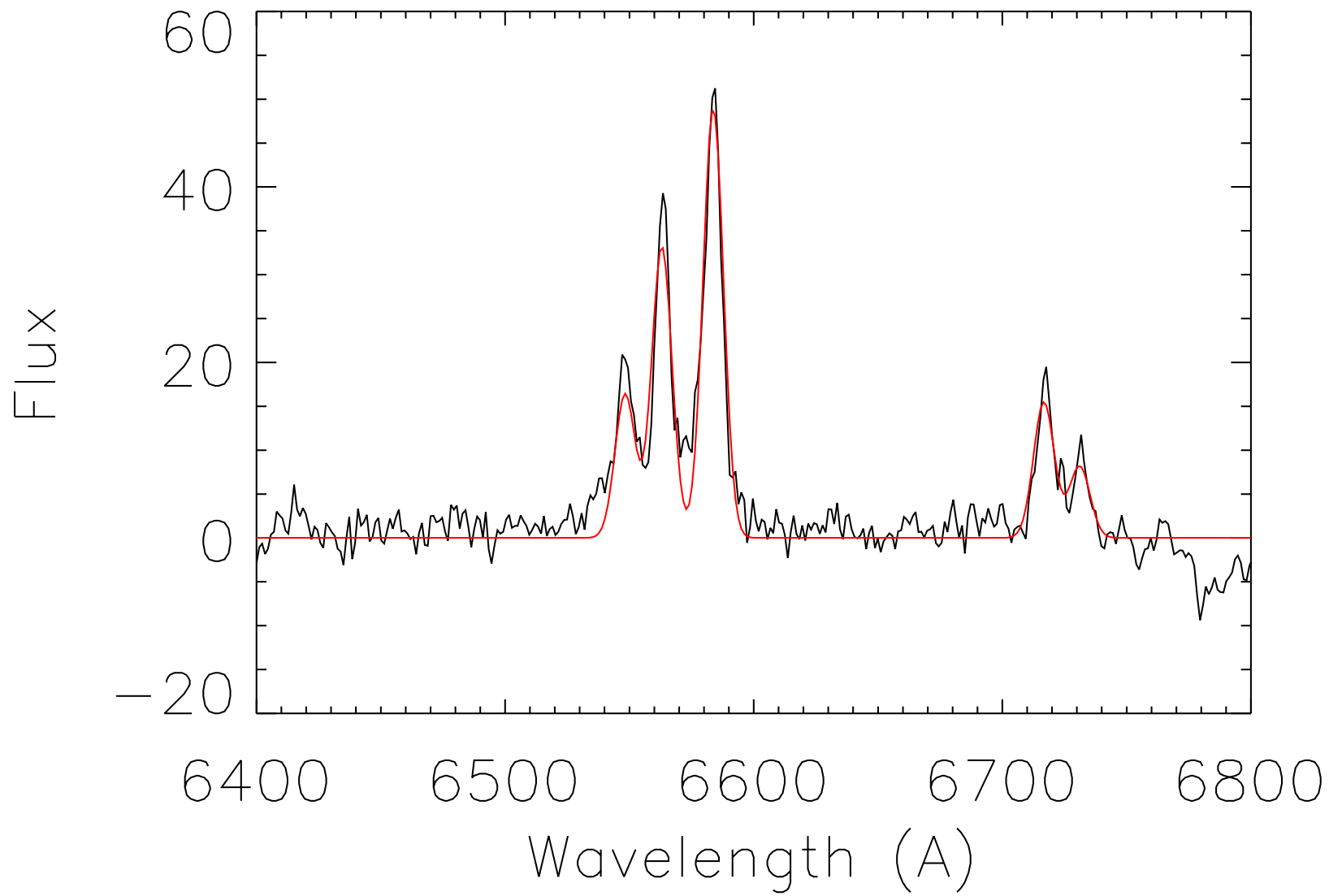
Galaxy	χ^2 (Fit)	FWHM (Narrow)	FWHM (broad)	Error
NGC2329	1.950651	688.31934	--	--
NGC541*	5.870661	814.09998	--	--
NGC2892*	10.60138	1024.5181	--	--
IC989	11.4826	325.16415	--	--
UGC12064	39.52744	994.5755	--	--
NGC5635**	40.72891	217.60678	--	--
NGC7052**	56.32169	775.68176	--	--

7 with no broad H α

NOAO/IRAF V2.14EXPORT fixts@messier.local Thu 09:58:44 25-Mar-2010
[n1961_dslog.imh]: ngc1961 1200. ap:1 beam:1



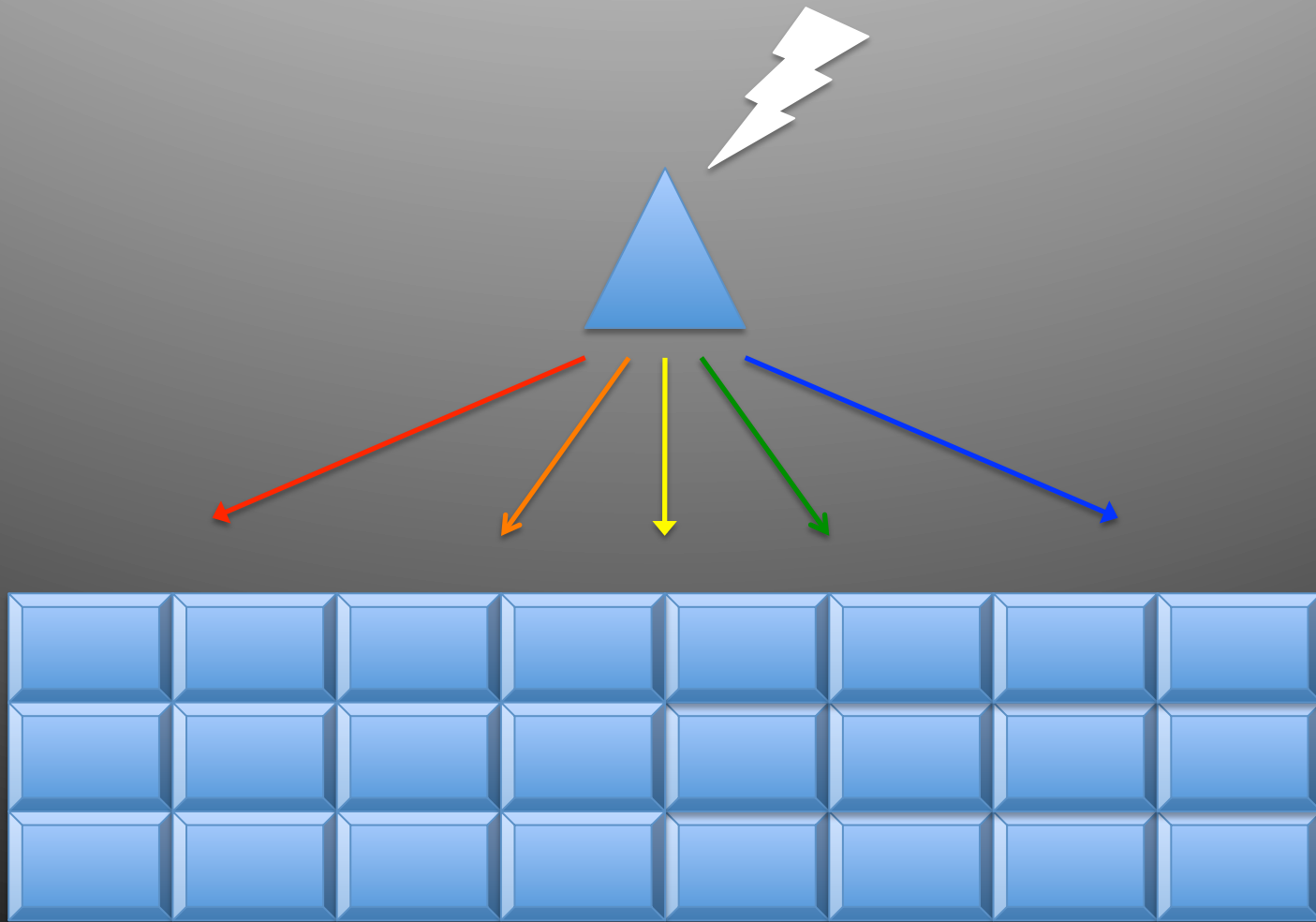




Thank you

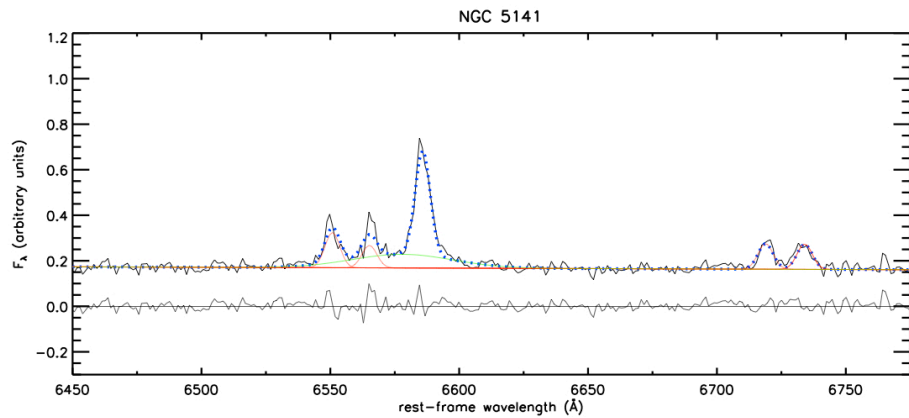
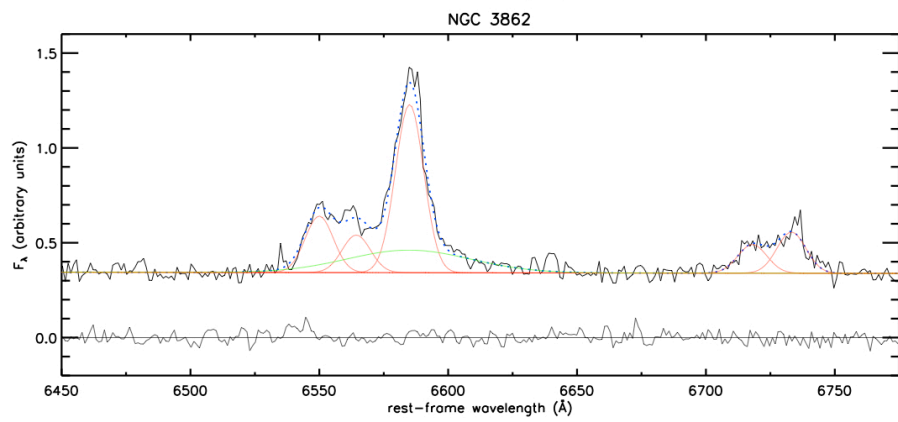
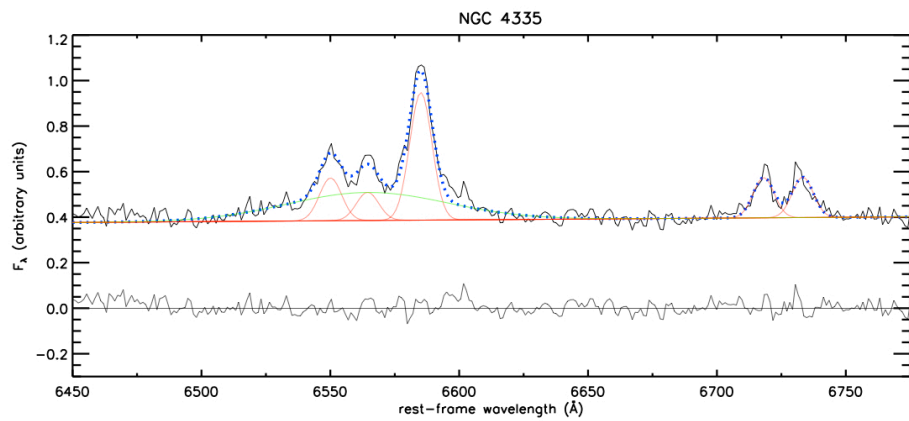
- NASA
- Dr. Anca Constantin
- Members of AGN LAIR

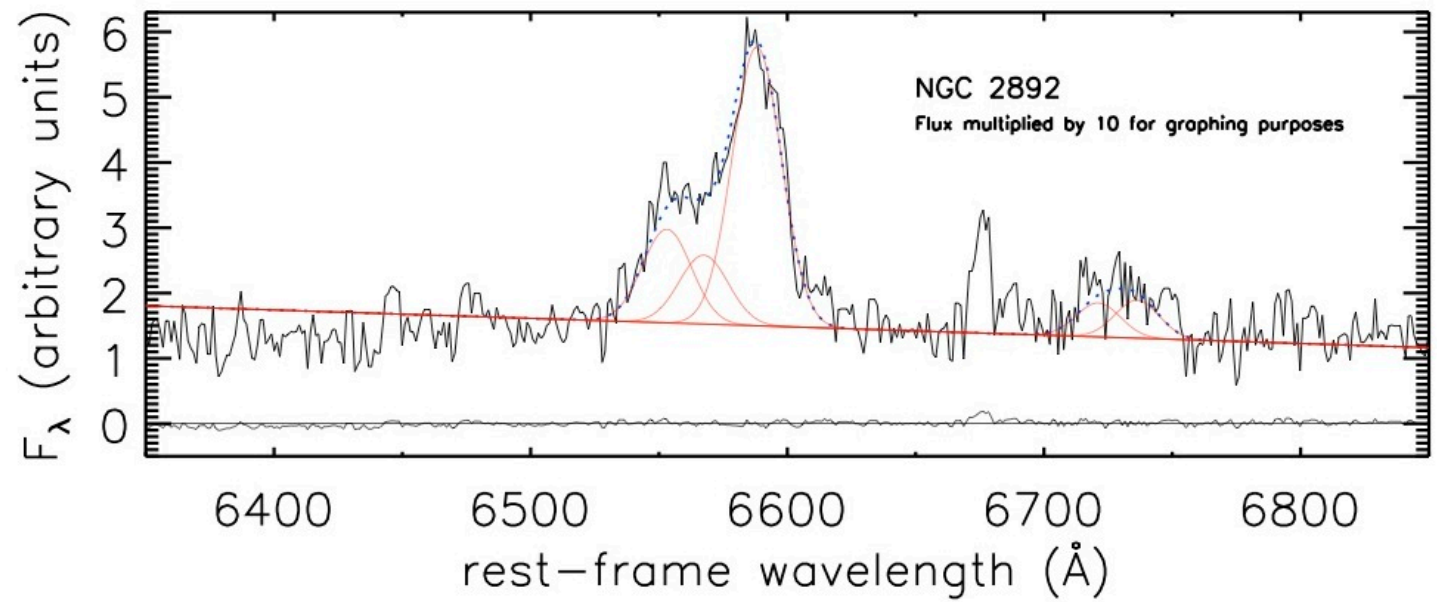
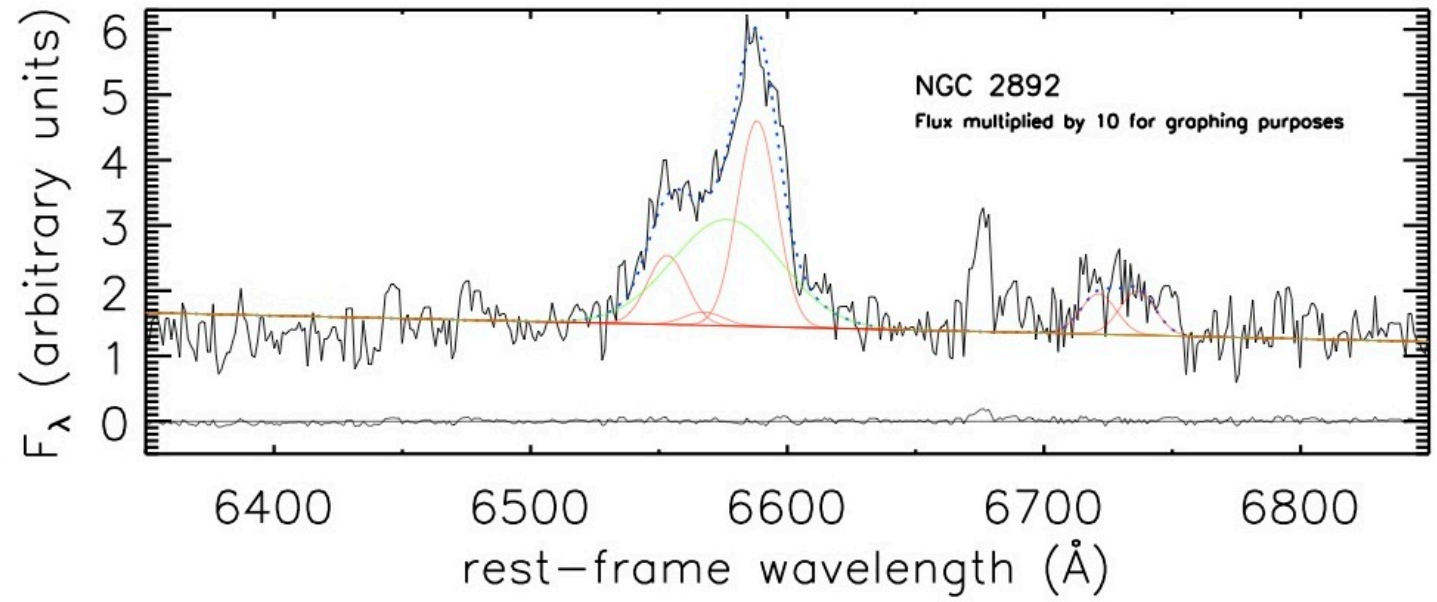
Dispersion Correction

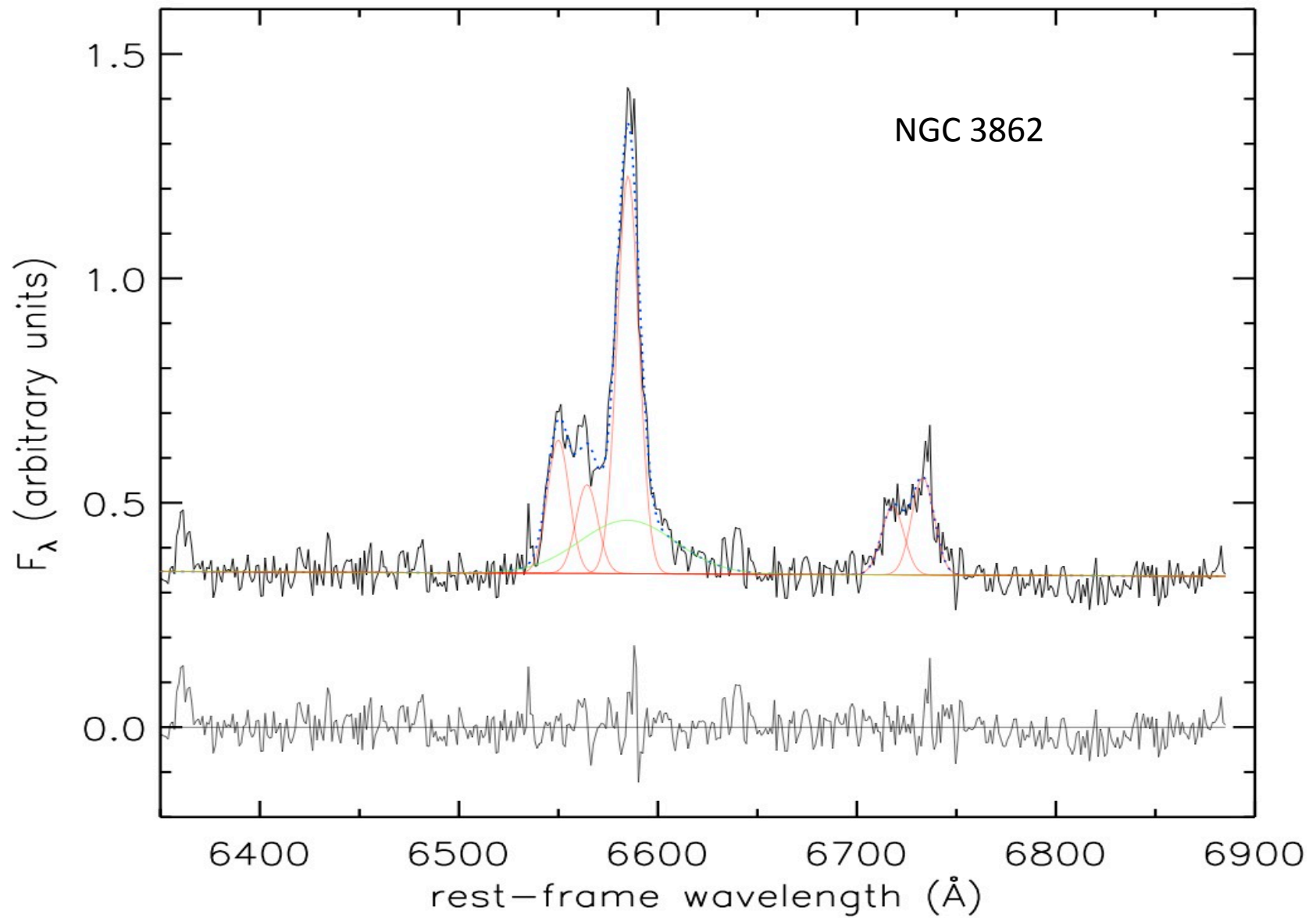


Parameters for Fitting

- Flux of NII doublet in 3:1 ratio
- FWHM for Ha, first NII fixed to NII (6583)
- Wavelength interval to SII, Ha fixed to NII
- FWHM for second SII doublet fixed to first SII line
- 1 linear (2 parameters), 5-6 Gaussians (9-12 parameters total)





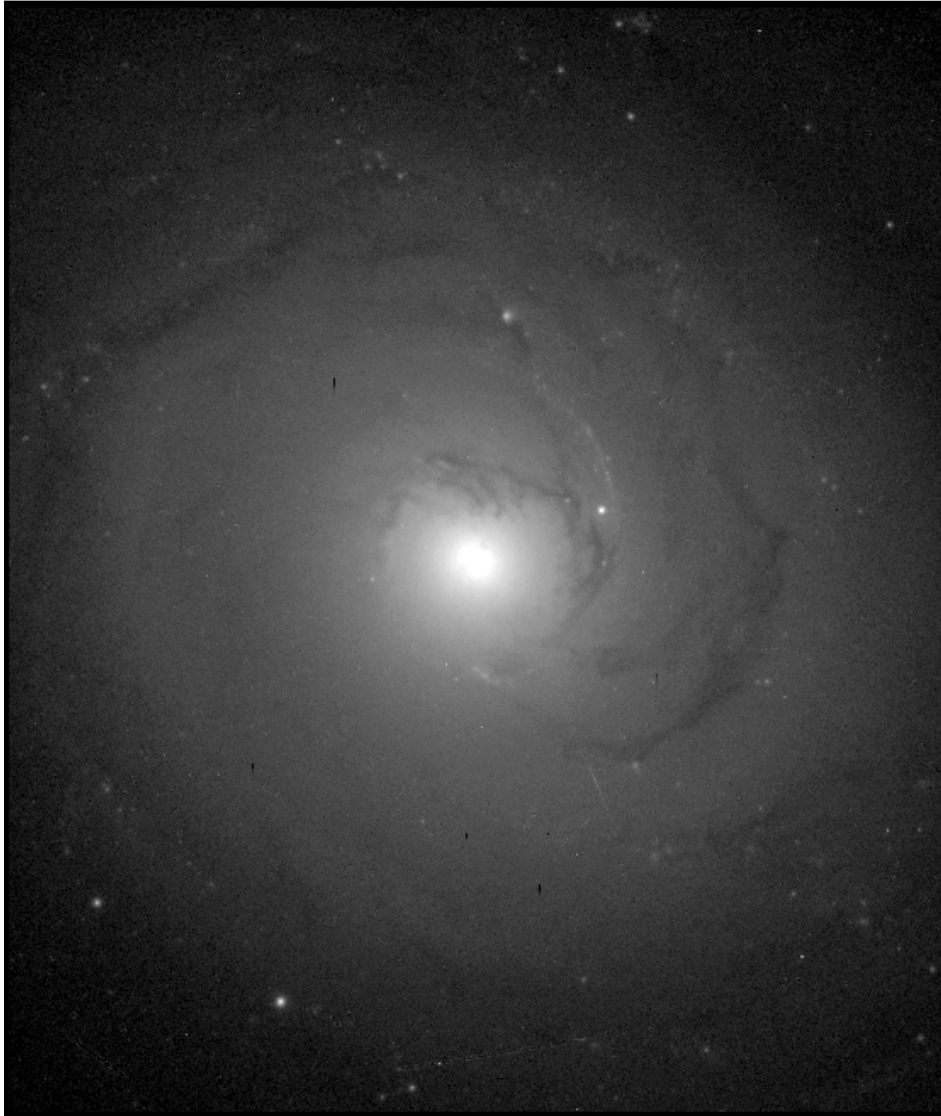


Galaxy	χ^2 (Fit)	FWHM (Narrow)	FWHM (broad)	Error
NGC3862	1.57279	588.63574	2564.2517	432.95

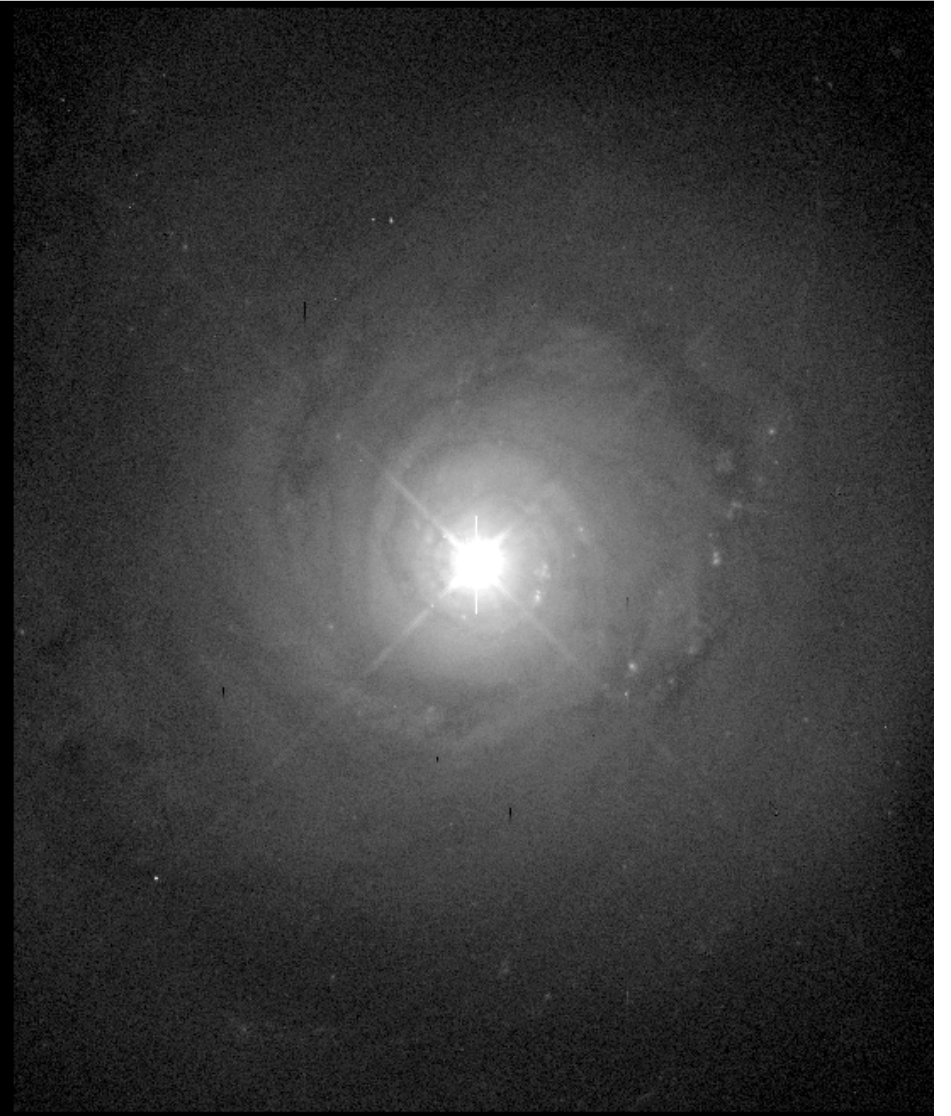
LINERs



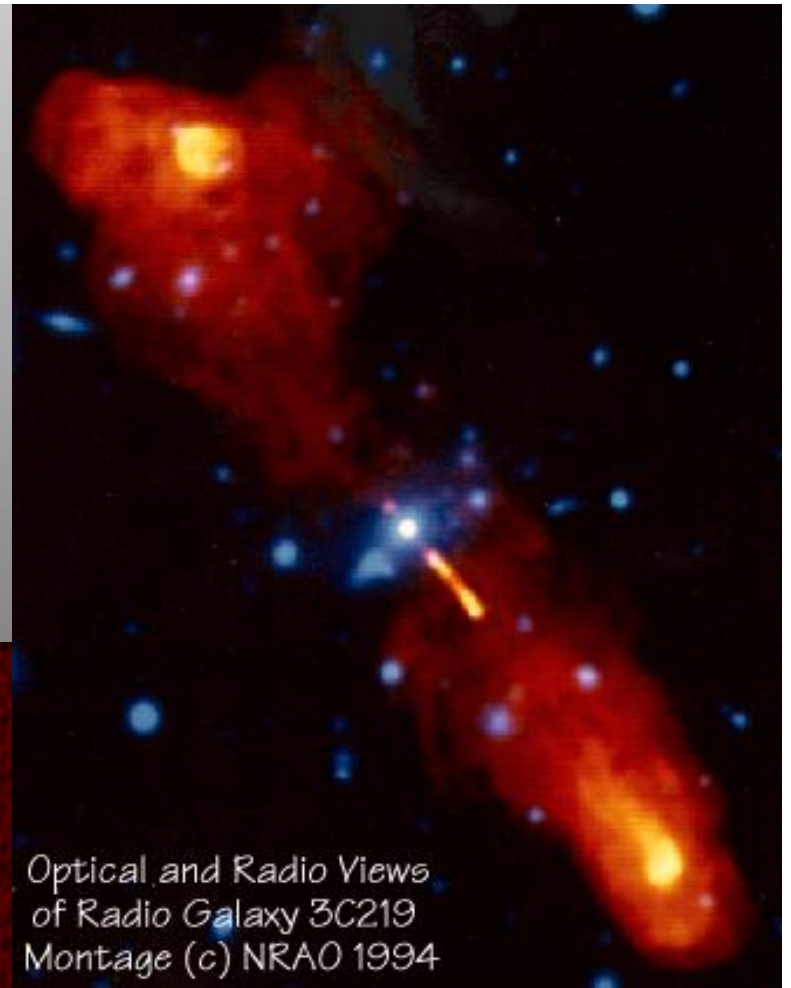
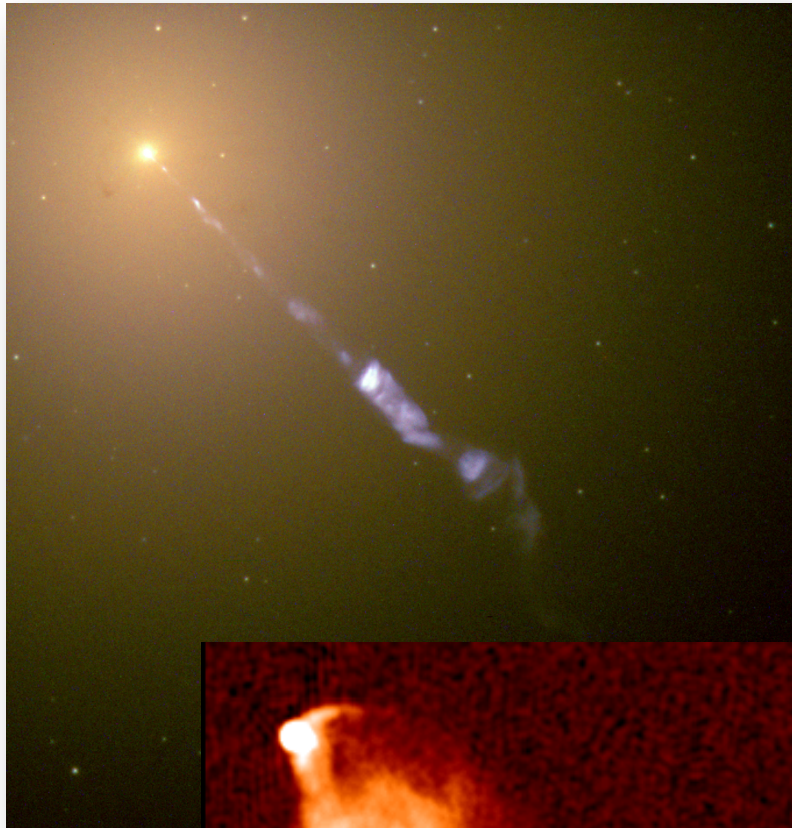
ions



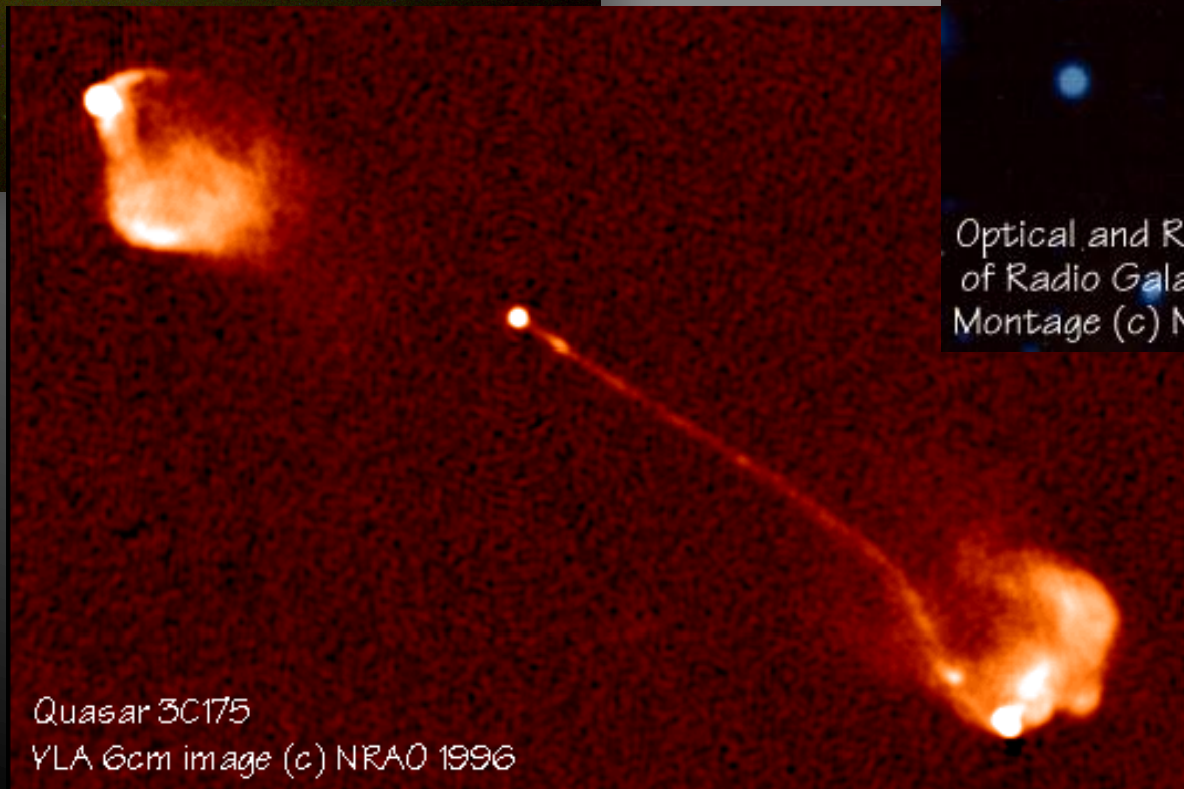
NGC 3277, No AGN



NGC 5548, AGN



Optical and Radio Views
of Radio Galaxy 3C219
Montage (c) NRAO 1994



Quasar 3C175
YLA 6cm image (c) NRAO 1996

From Here ...

1. Reduce Multiple Mirror Telescope images
2. Fit MMT data
3. Compare MMT results with HST results

