

Determining Inclinations of AGN via NLR Kinematics



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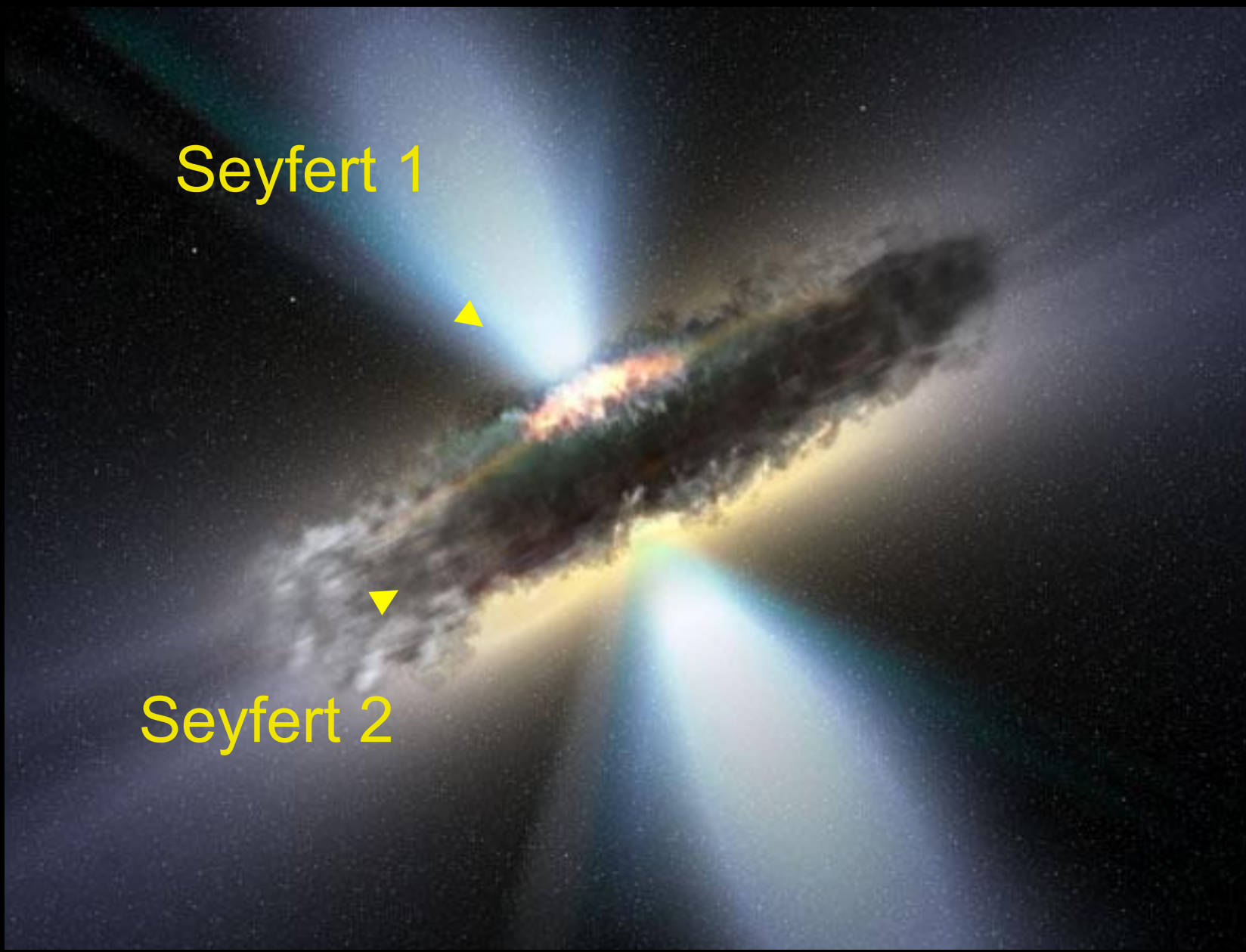
Jane Turner (UMBC)

October 16, 2011

Seyfert 1



Seyfert 2





Seyfert 1

Seyfert 2

Seyfert 2

Seyfert 1

Individual AGN Inclinations Unknown!

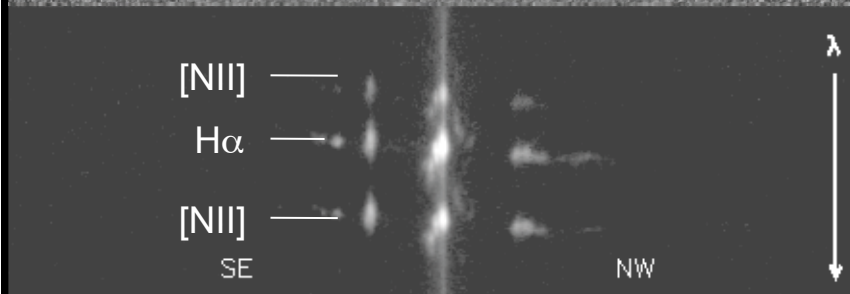
Why Is Inclination Important?

Accretion Disk SED

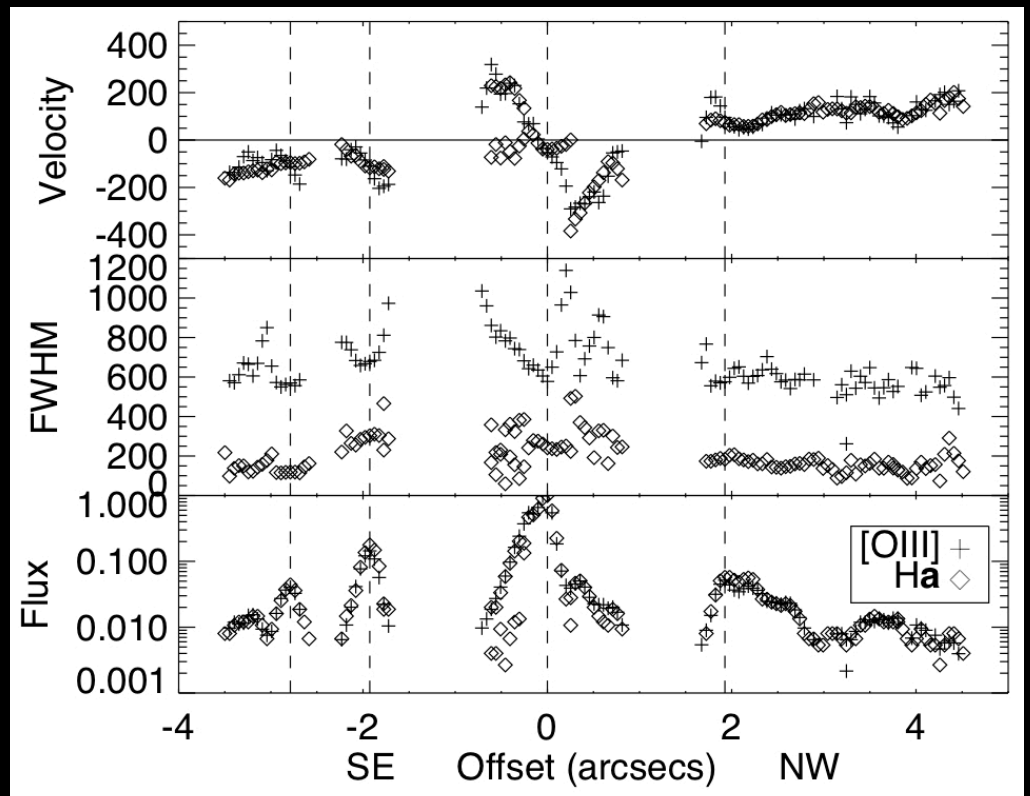
Black Hole Mass

Column Density (N_{H})

Extinction (A_{λ})

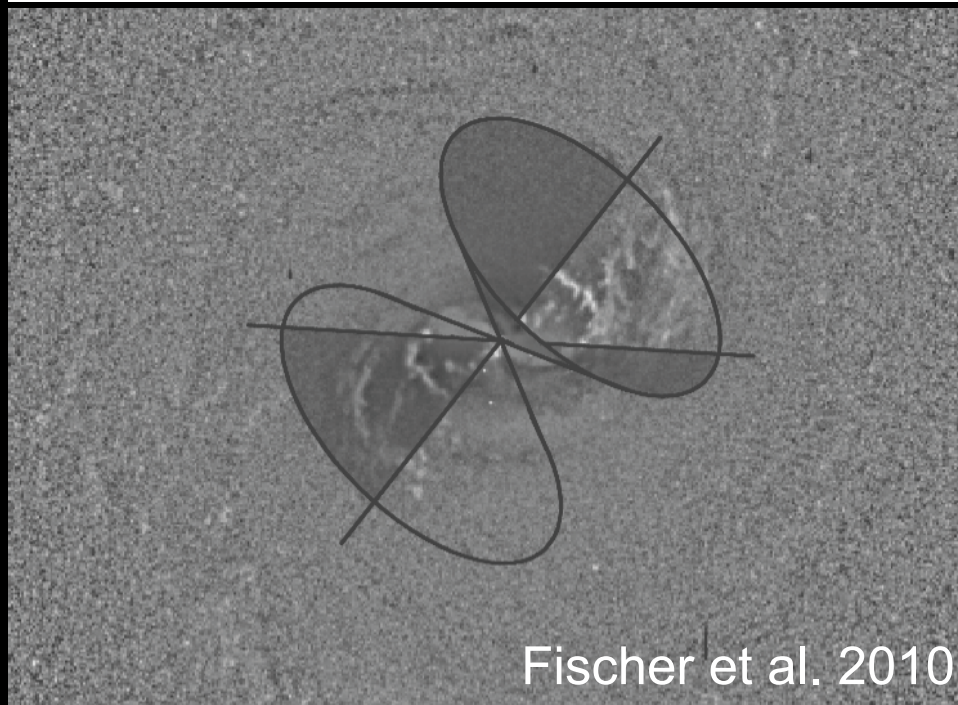
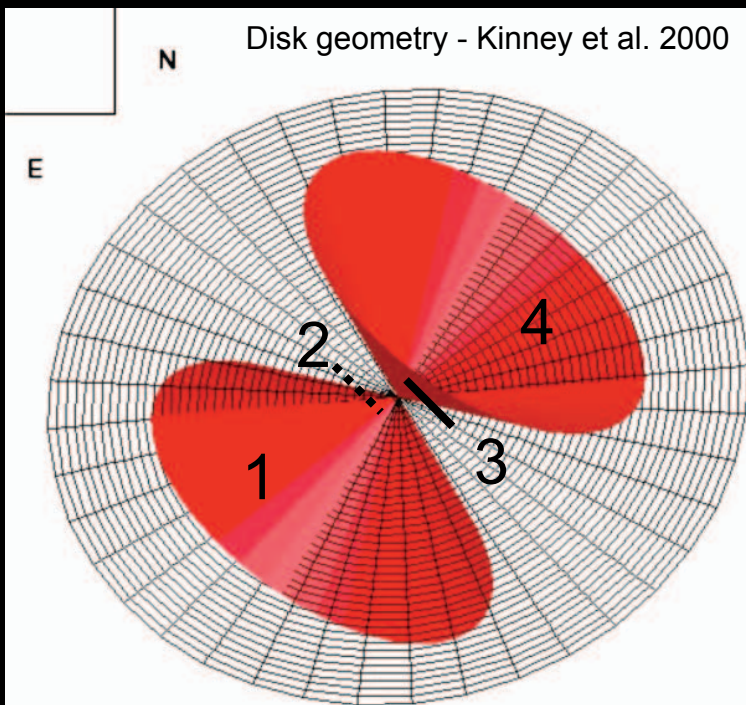
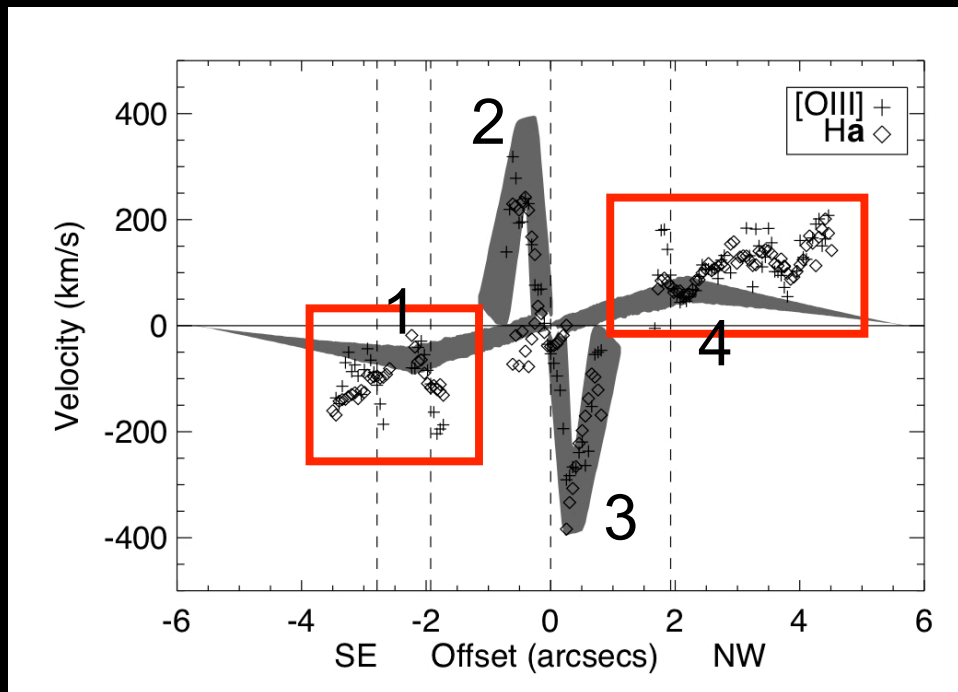
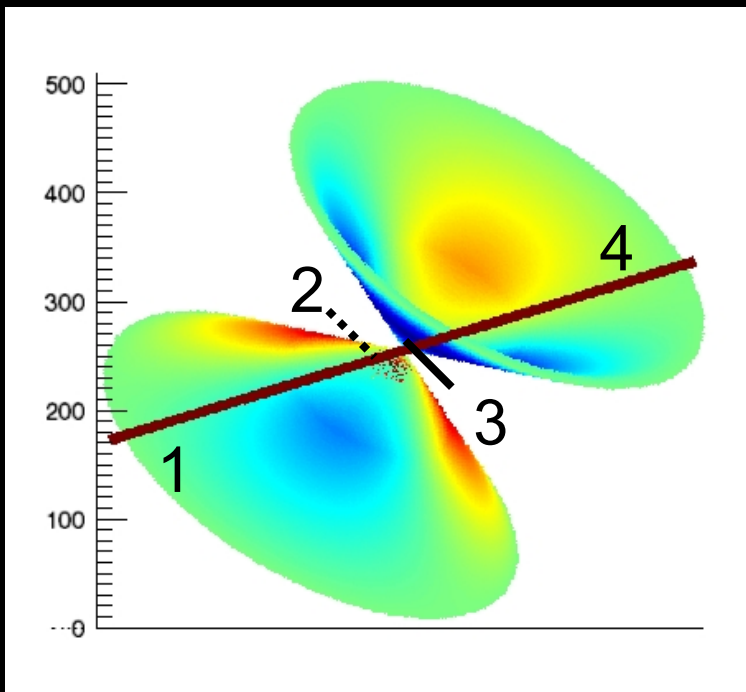


Fischer et al. 2010



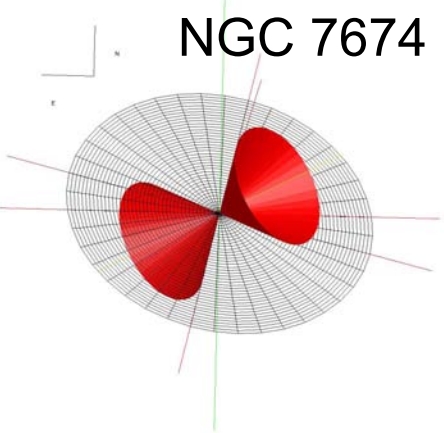
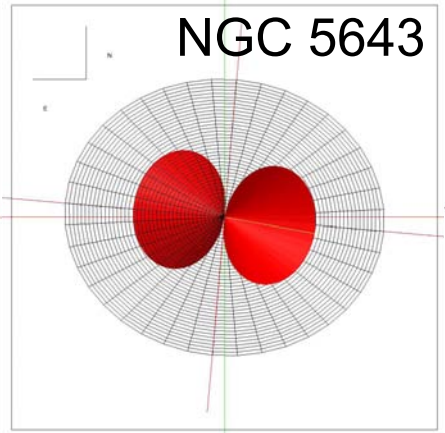
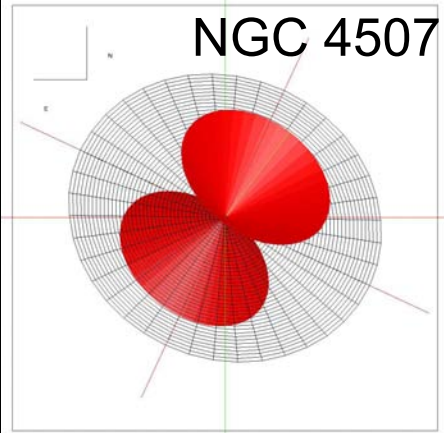
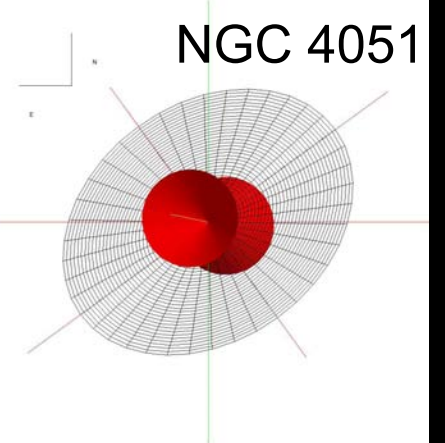
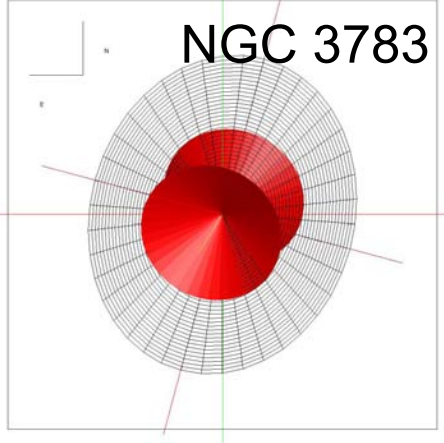
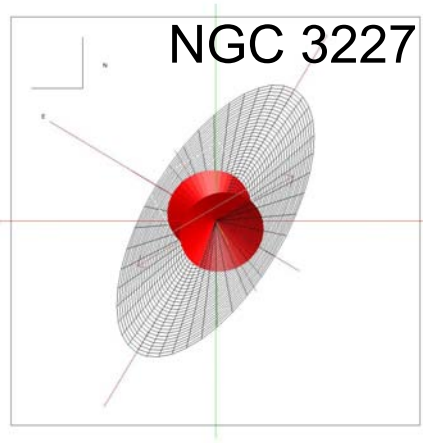
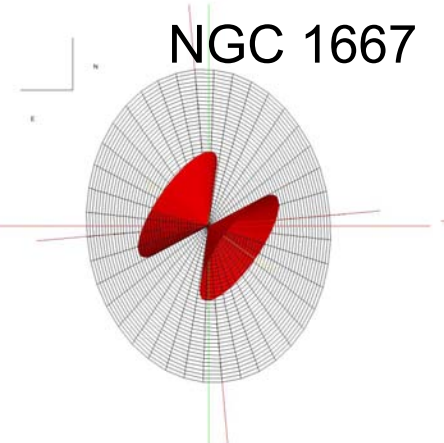
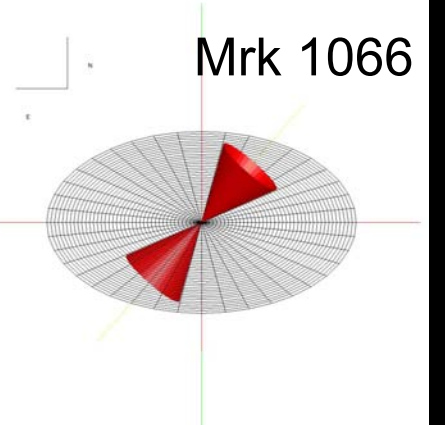
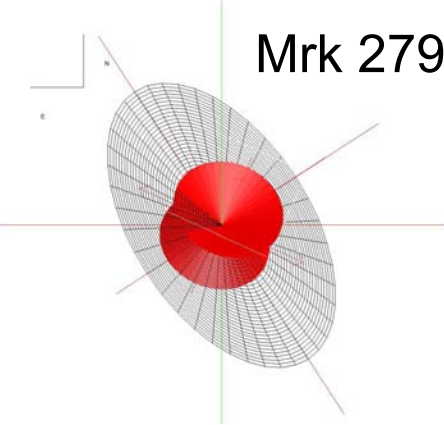
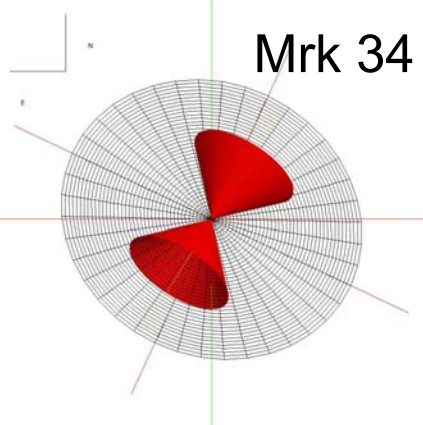
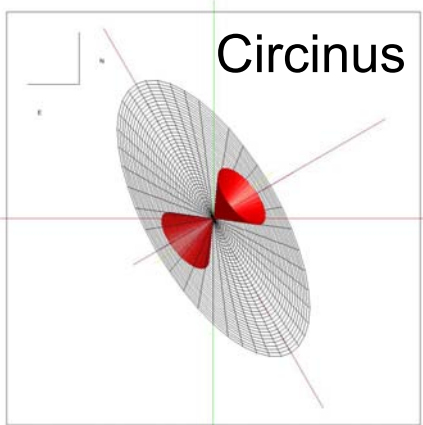
Measure Doppler-shifted velocities of [O III] and H α

Fit one or multiple Gaussians per spectrum along slit

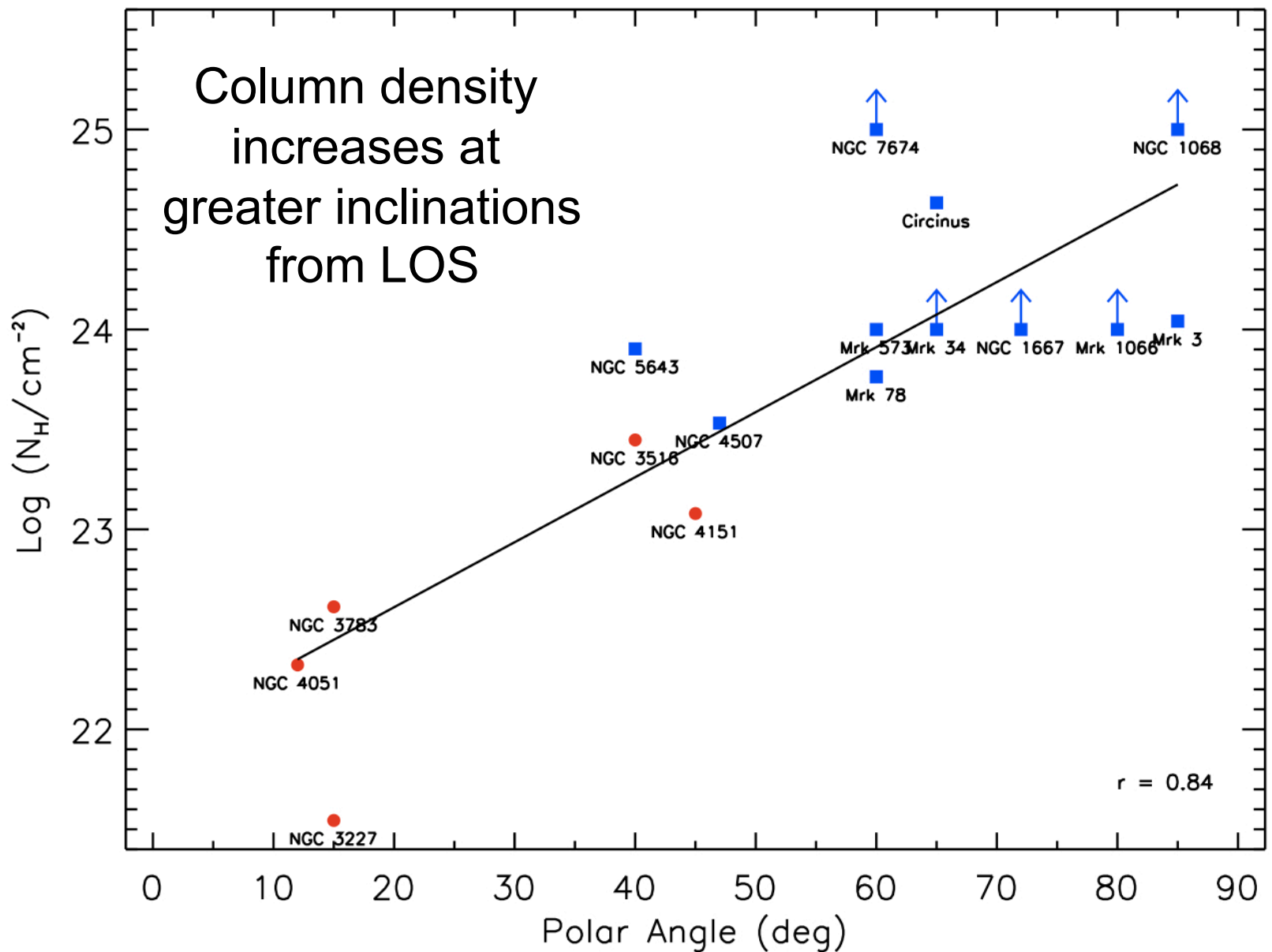


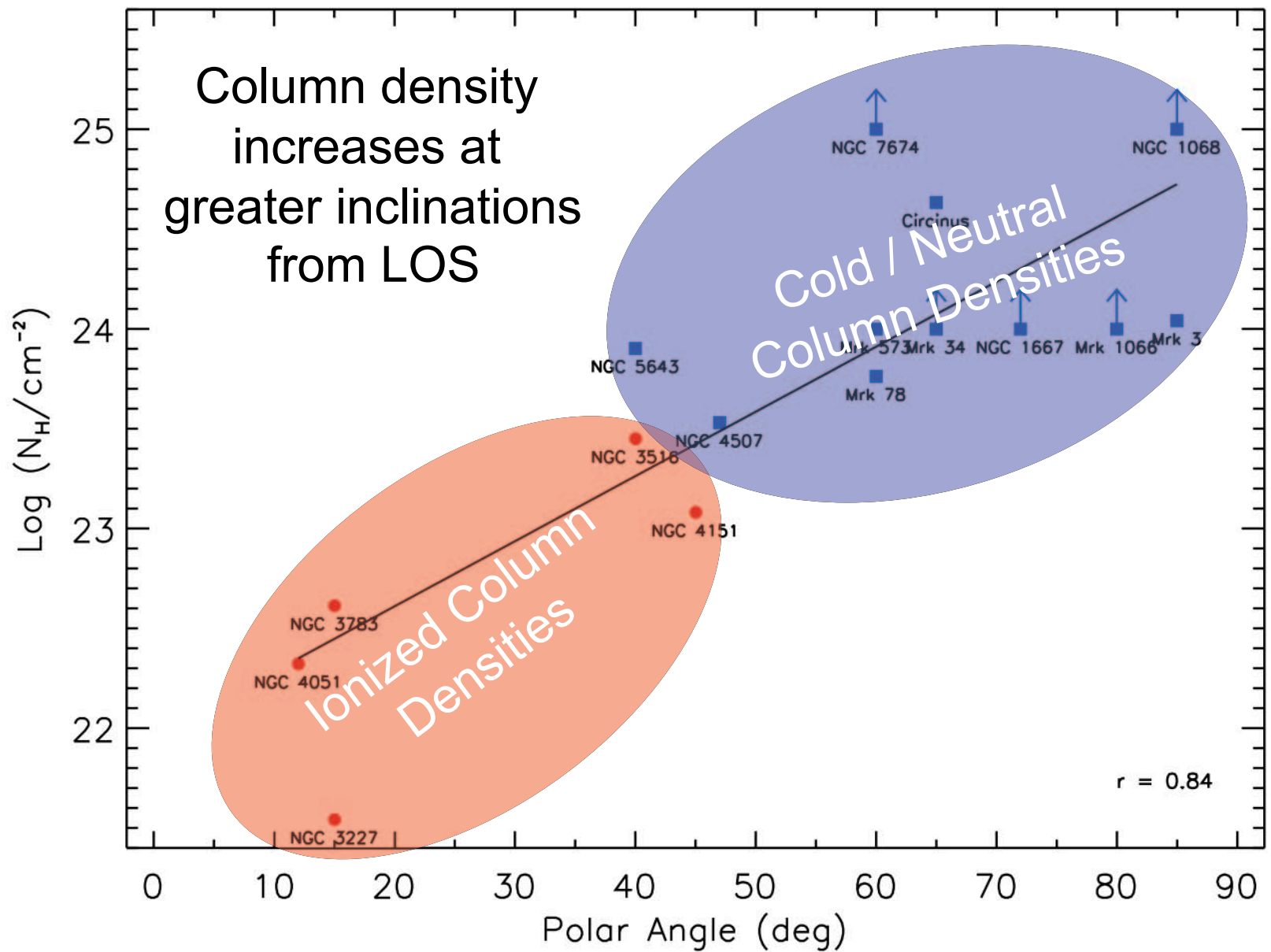
Increasing the sample size

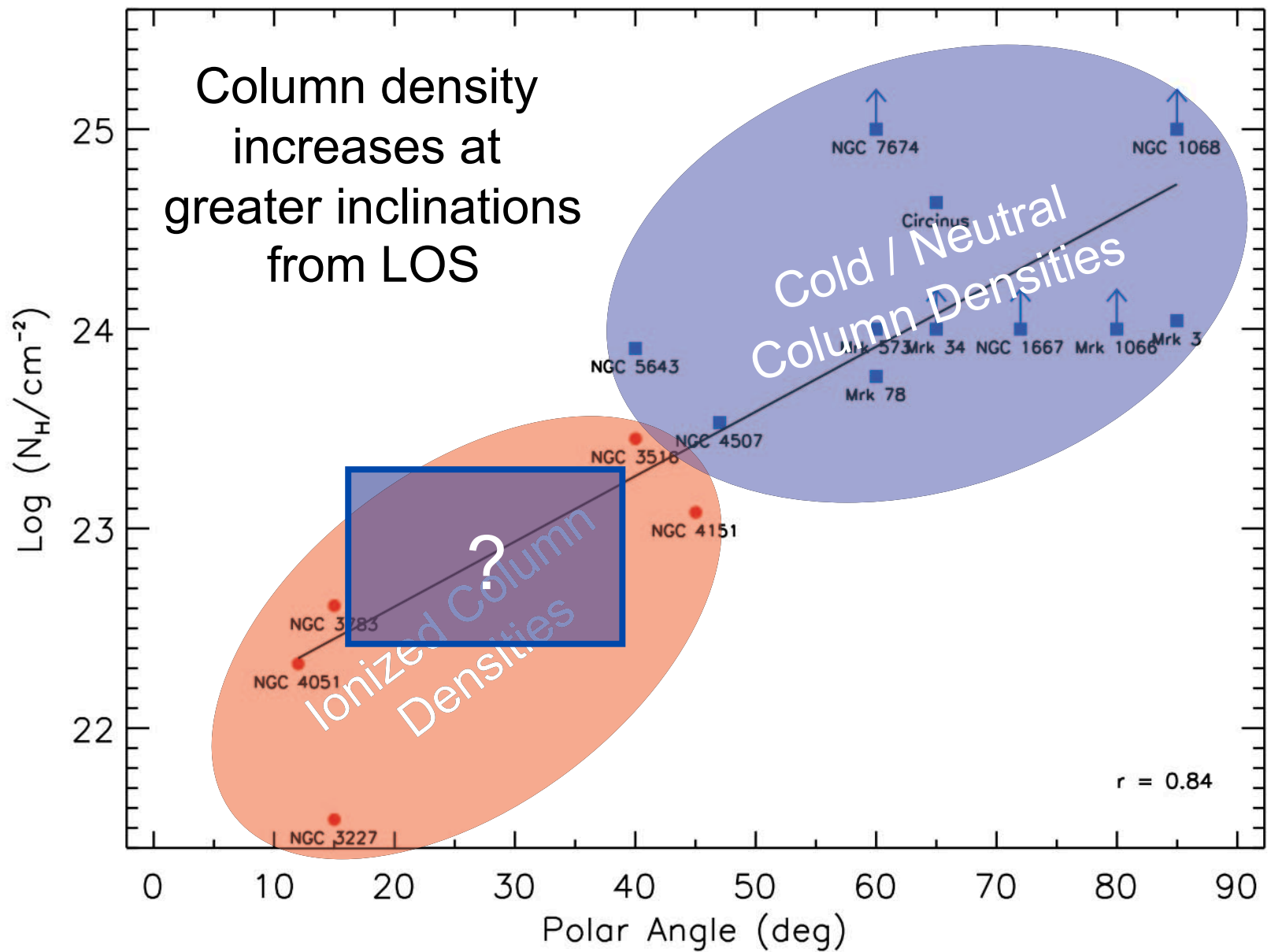
- More AGN inclinations → possible to identify any correlations with observed properties
- New / Archive HST STIS G430L / M long-slit and slitless spectra
- Archive HST STIS G750M long-slit spectra
- Total : **52 Seyfert galaxies**
 - 16 show definitive outflow kinematics
 - 17 show rotational kinematics
 - 4 show complex kinematics (in situ acceleration?)
 - 11 compact targets
 - 2 targets with slit positions outside NLR



Column density
increases at
greater inclinations
from LOS



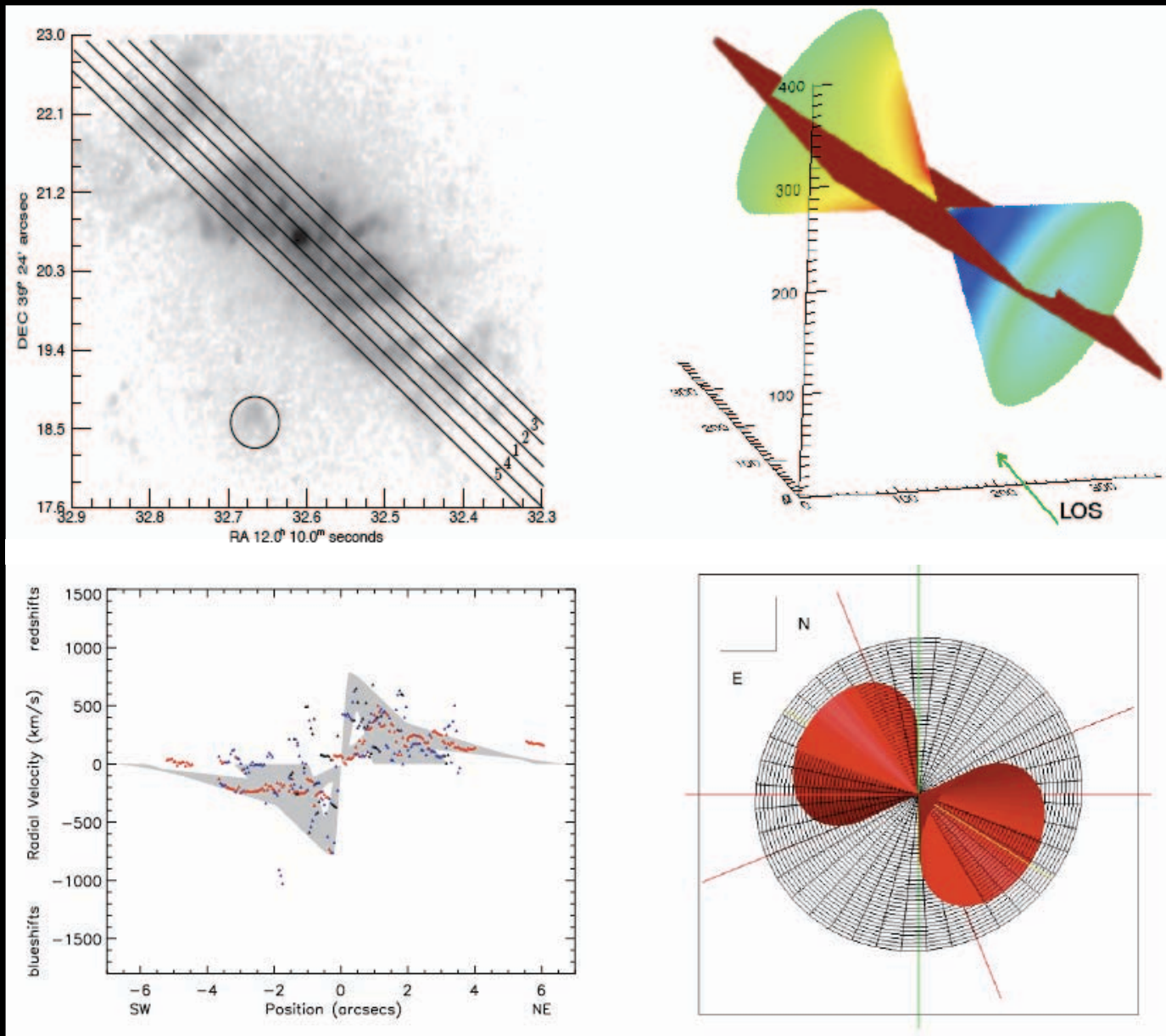




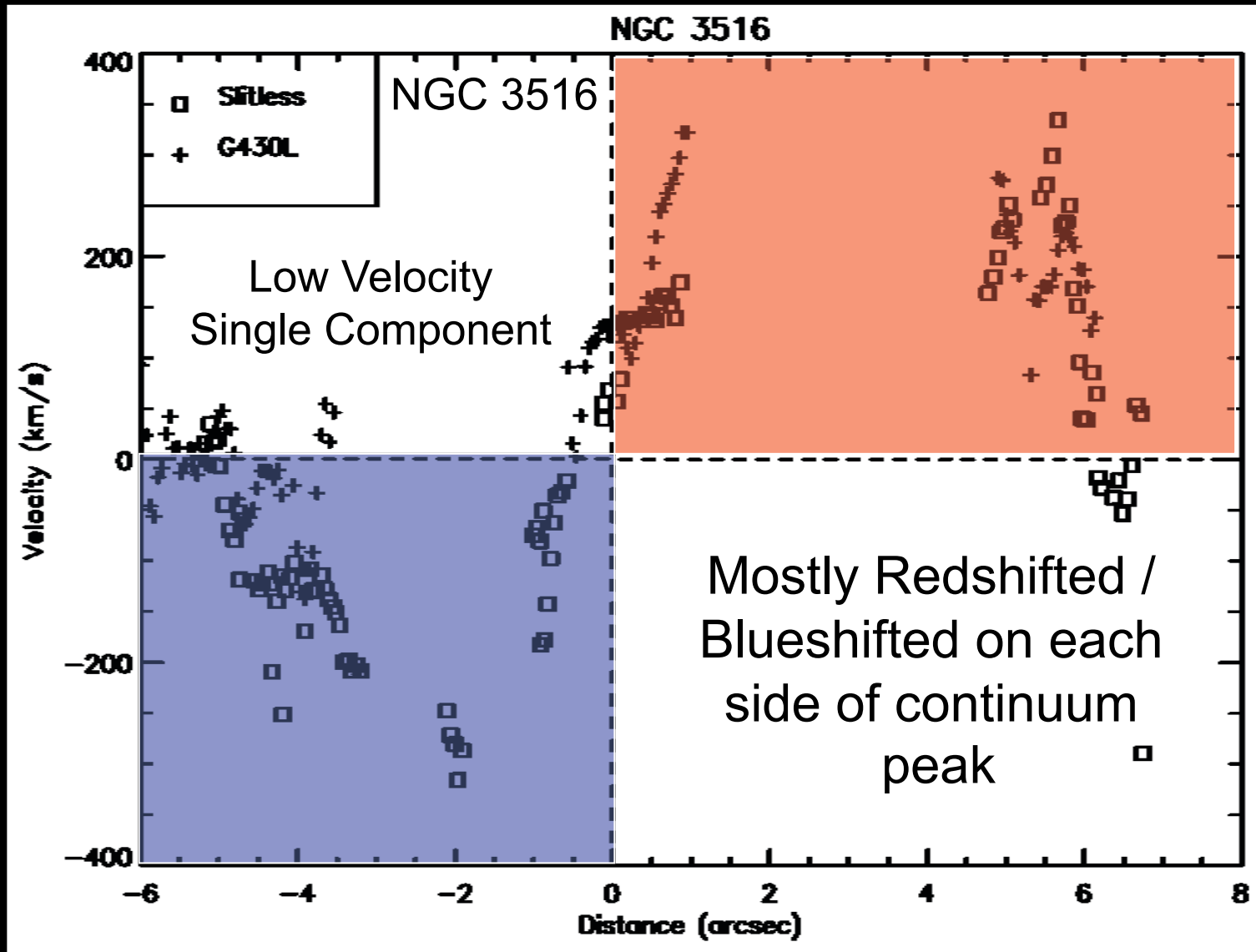
Conclusions

- NLR kinematics can be used to determine AGN inclinations
 - Limited only by STIS slit position
- Correlations exist between inclination and observable AGN parameters
 - Positive correlation for column density and polar angle between bicone axis and LOS
 - Correlations with other parameters likely exist (see Mike Crenshaw's talk)
- More data are needed
 - HST observations of more bright, nearby AGN pulled from RSA and Ho Palomar samples
 - AGN covering N_H not probed by current sample

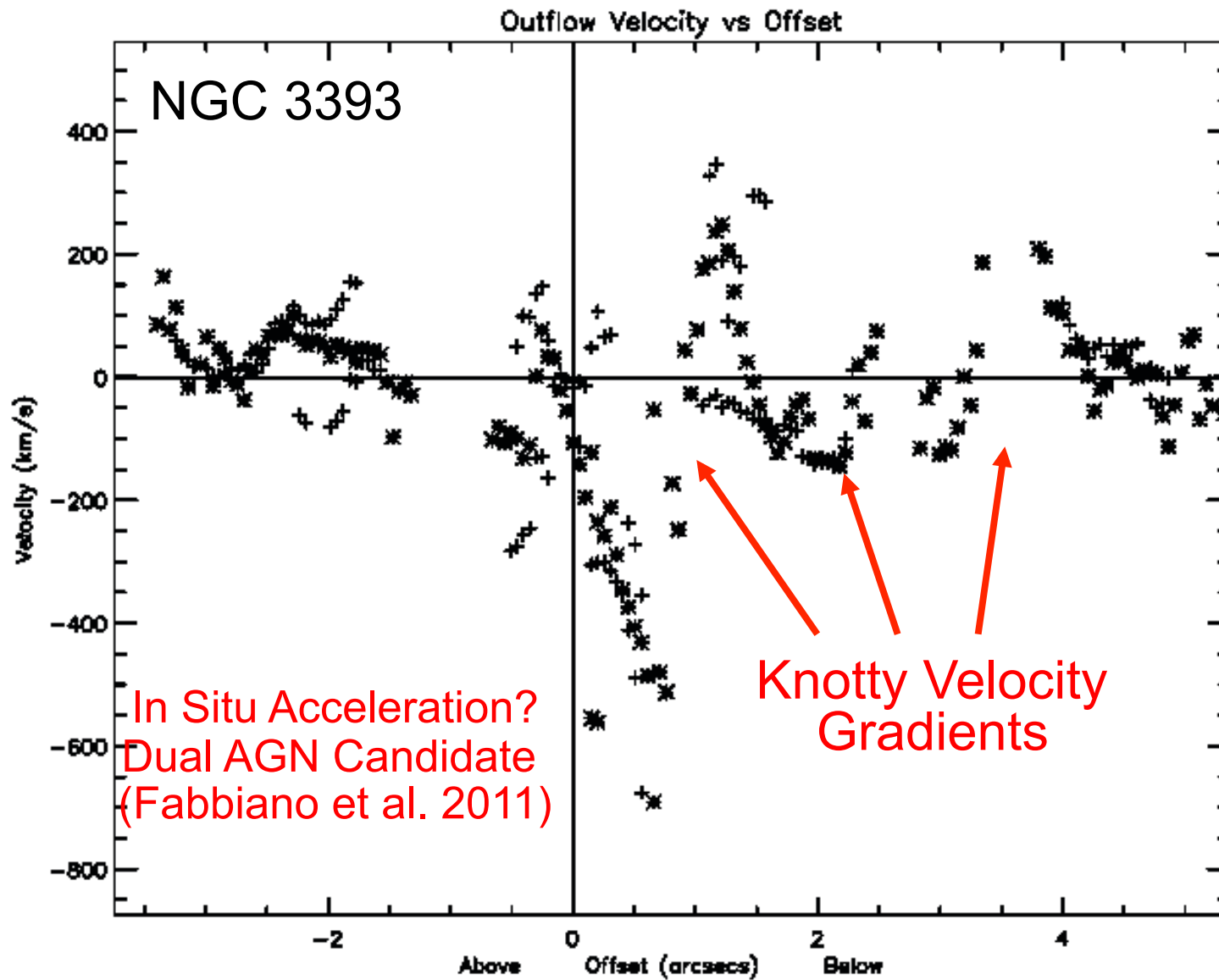
Previous Models - NGC 4151



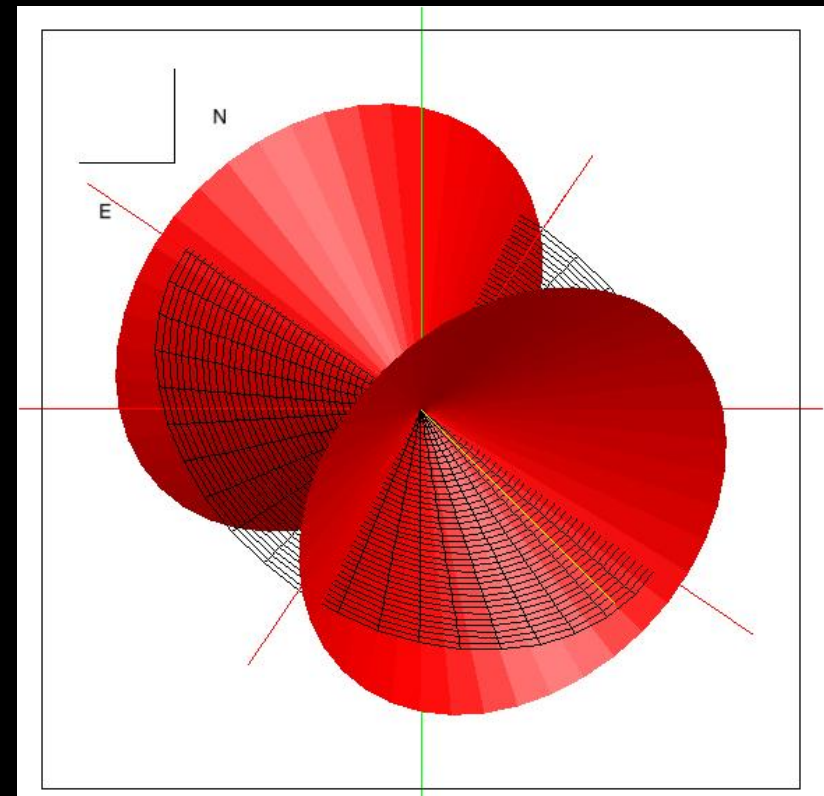
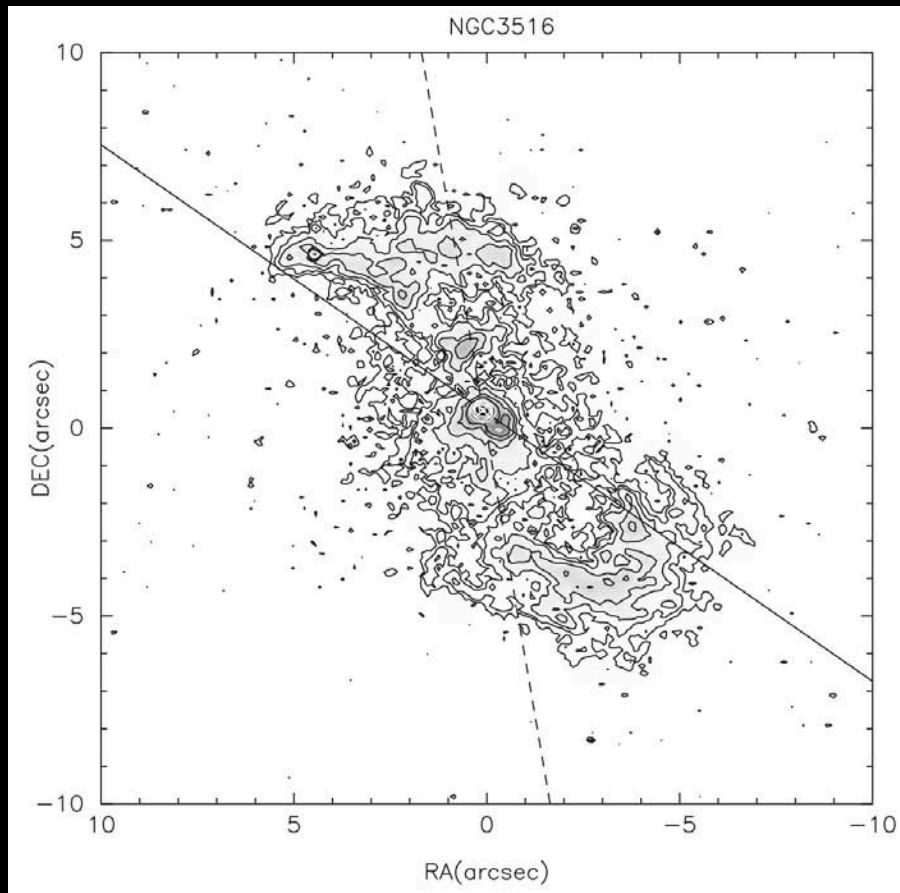
Rotational Kinematics



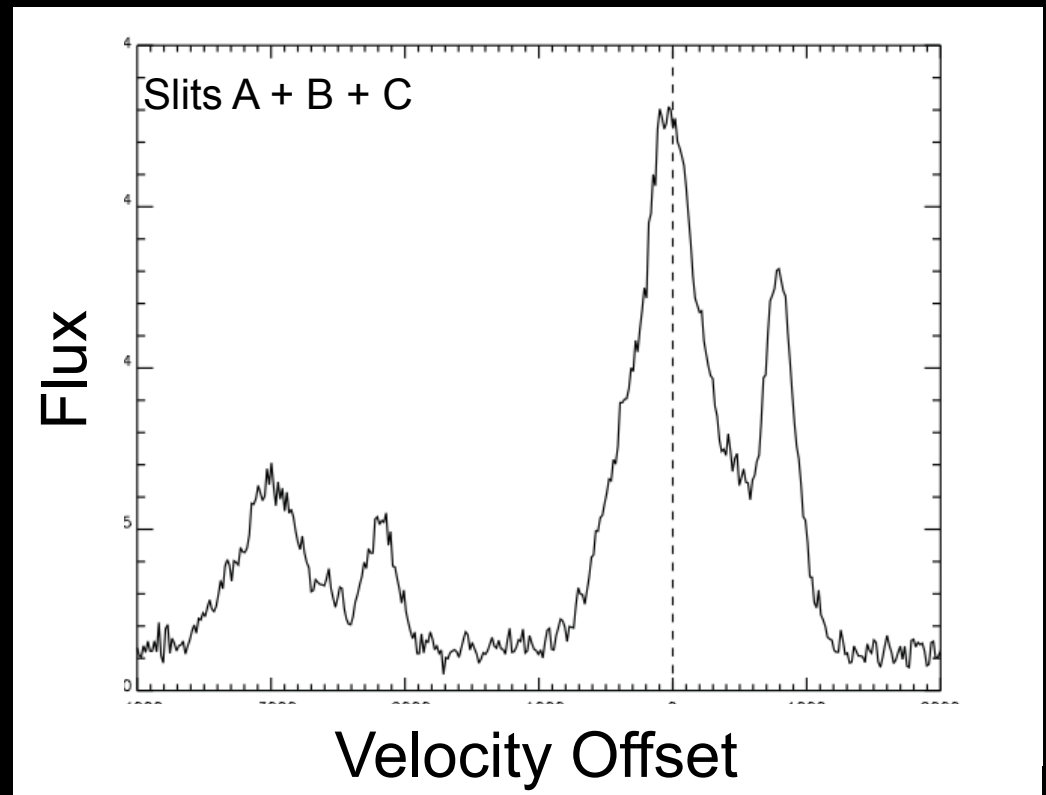
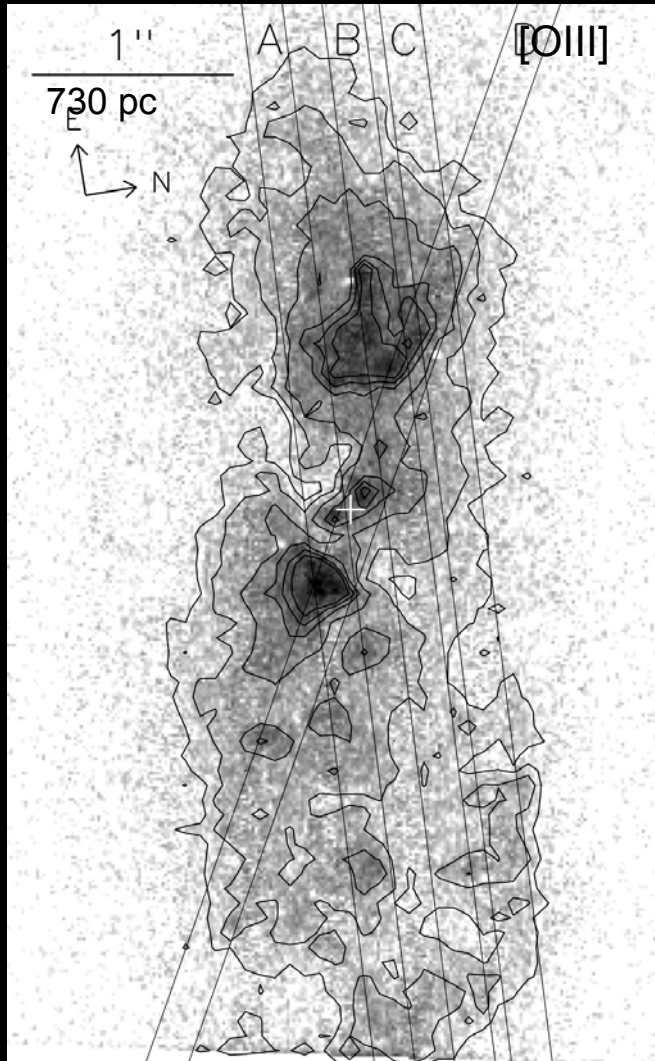
Complex Kinematics



NGC 3516 - Geometric Model

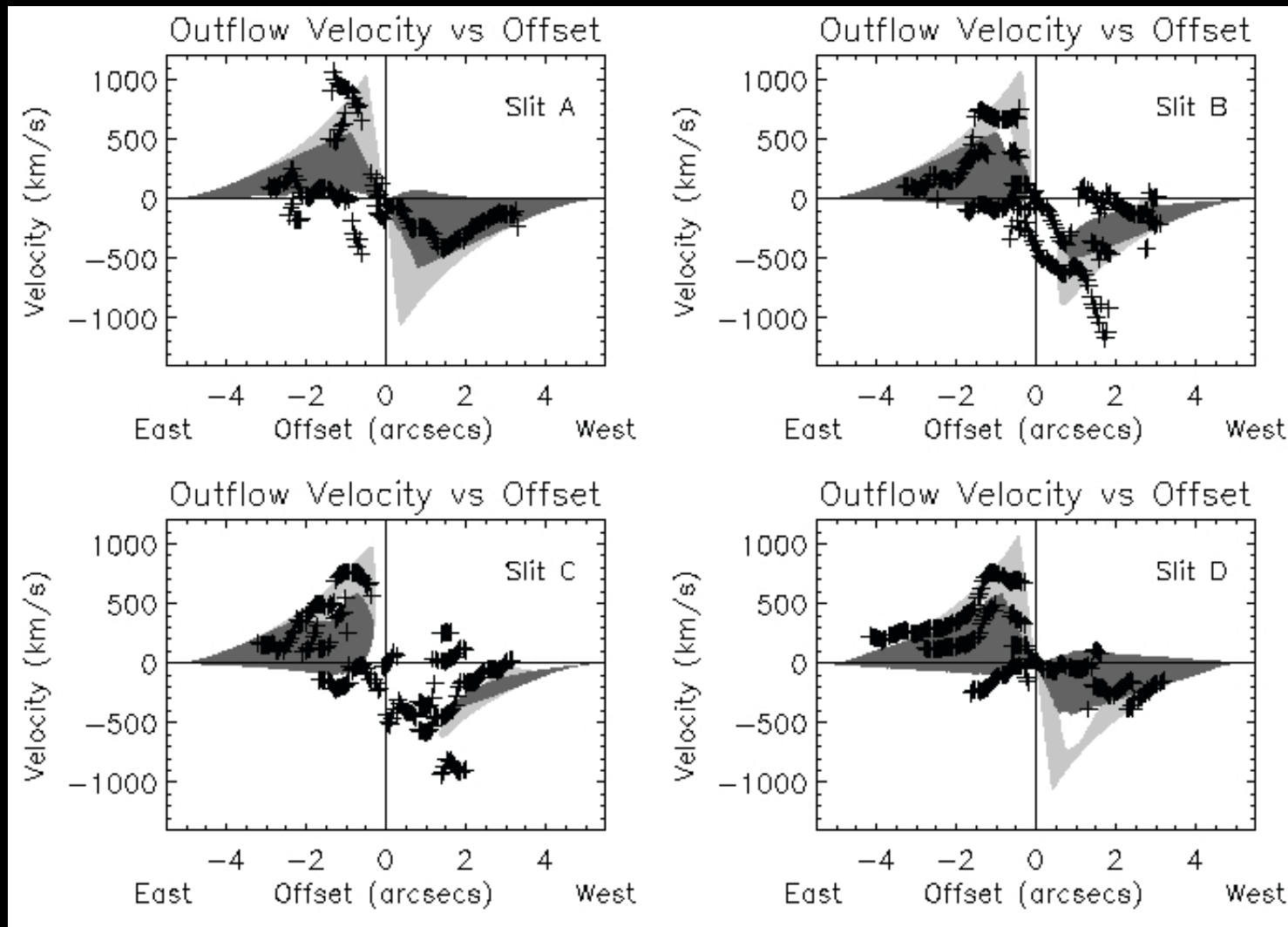


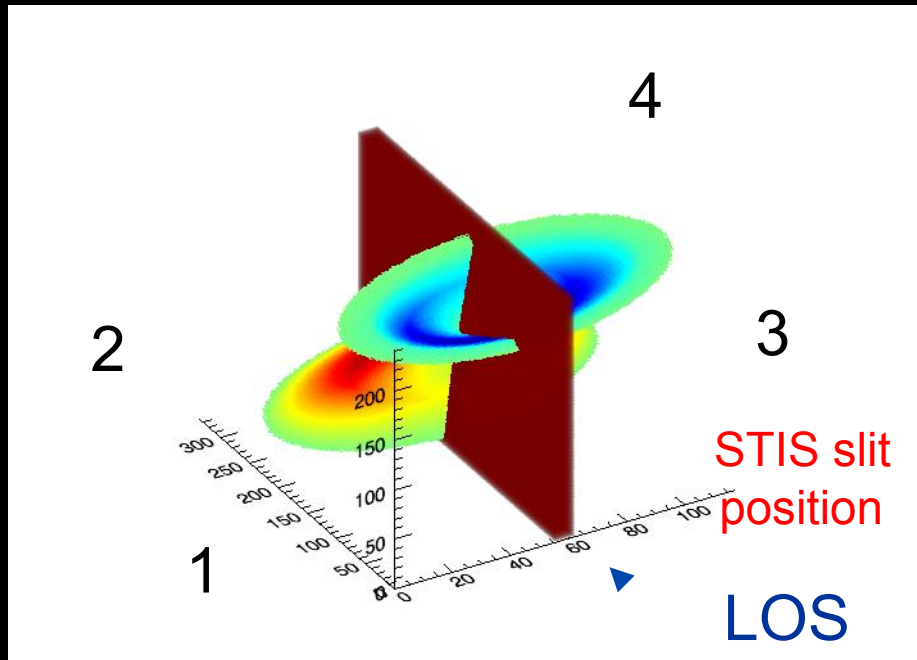
Other Applications: Double Emission-Line AGN



Fischer et al. 2011

Other Applications: Double Emission-Line AGN





Near cone becomes more
Blueshifted
 Far cone becomes more
Redshifted
 As bicone axis tilts out of
 the plane of the sky

Max radial velocities
 increase as bicone axis
 tilts toward our line of sight

Blueshifted Redshifted

