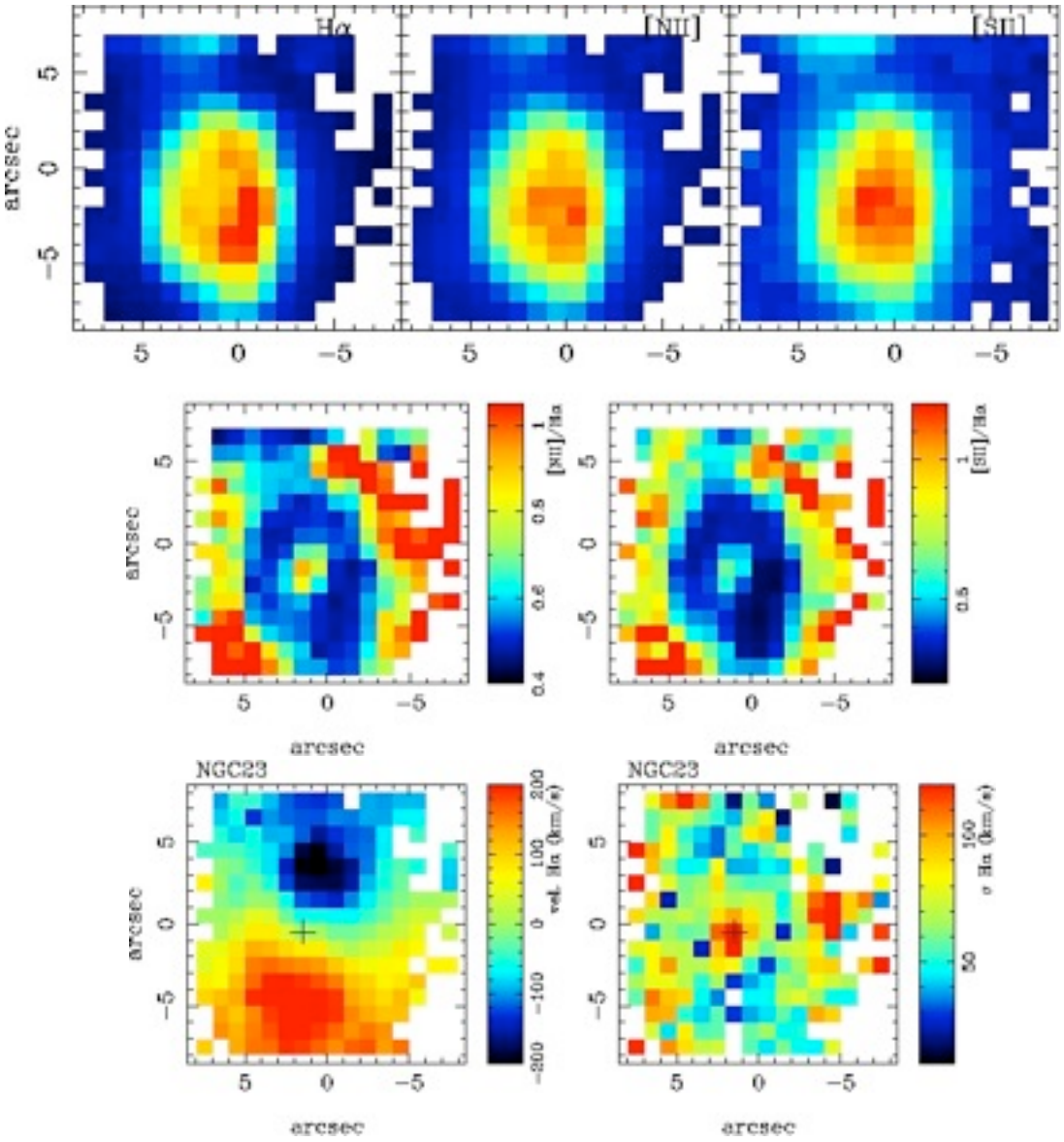
A. Alonso Herrero

PMAS Optical Integral Field Spectroscopy of Luminous Infrared Galaxies

The general properties (activity class, star formation rates, metallicities, extinctions, average ages) of local luminous infrared galaxies (LIRGs) are well known since large samples have been the subject of numerous spectroscopic works. There are, however, relatively few studies of large samples of LIRGs using integral field spectroscopy (IFS). We present optical (3800-7200A) IFS data taken with the Potsdam Multi-Aperture Spectrophotometer (PMAS) of the central few kiloparsecs of eleven LIRGs. We complemented the PMAS observations with existing HST/NICMOS Pa-alpha imaging. The optical continua of selected regions are well fitted with combinations of evolved (0.7-10Gyr) and ionizing (1-20Myr) stellar populations. The latter is more obscured than the evolved population, and has visual extinctions in good agreement with those obtained from the Balmer decrement. Except for NGC 7771, we found no evidence for an important contribution to the optical light from an intermediate-aged stellar population (100-500Myr). Even after correcting for stellar absorption, a large fraction of spaxels with low equivalent widths of Halpha in emission still show enhanced [NII]6584/Ha and [SII]6717,6731/Ha ratios. These ratios are likely to be produced by photoionization in HII regions and diffuse emission. These regions of enhanced line ratios are coincident with low surface brightness HII regions. The fraction of diffuse emission in LIRGs varies from galaxy to galaxy, and it is less than 60% as found in other starburst galaxies. The Halpha velocity fields over the central few kpc are generally consistent, at least to first order, with rotational motions. The velocity fields of most LIRGs are similar to those of disk galaxies, in contrast to the highly perturbed fields of most local, strongly interacting ULIRGs. The peak of the Halpha velocity dispersion coincides with the position of the nucleus and is likely to be tracing mass.



PMAS Observations of Luminous Infrared Galaxies

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Alonso-Herrero et al. 2009, A&A, 506, 1541
Alonso-Herrero et al. 2010, A&A, arXiv:1006.2219

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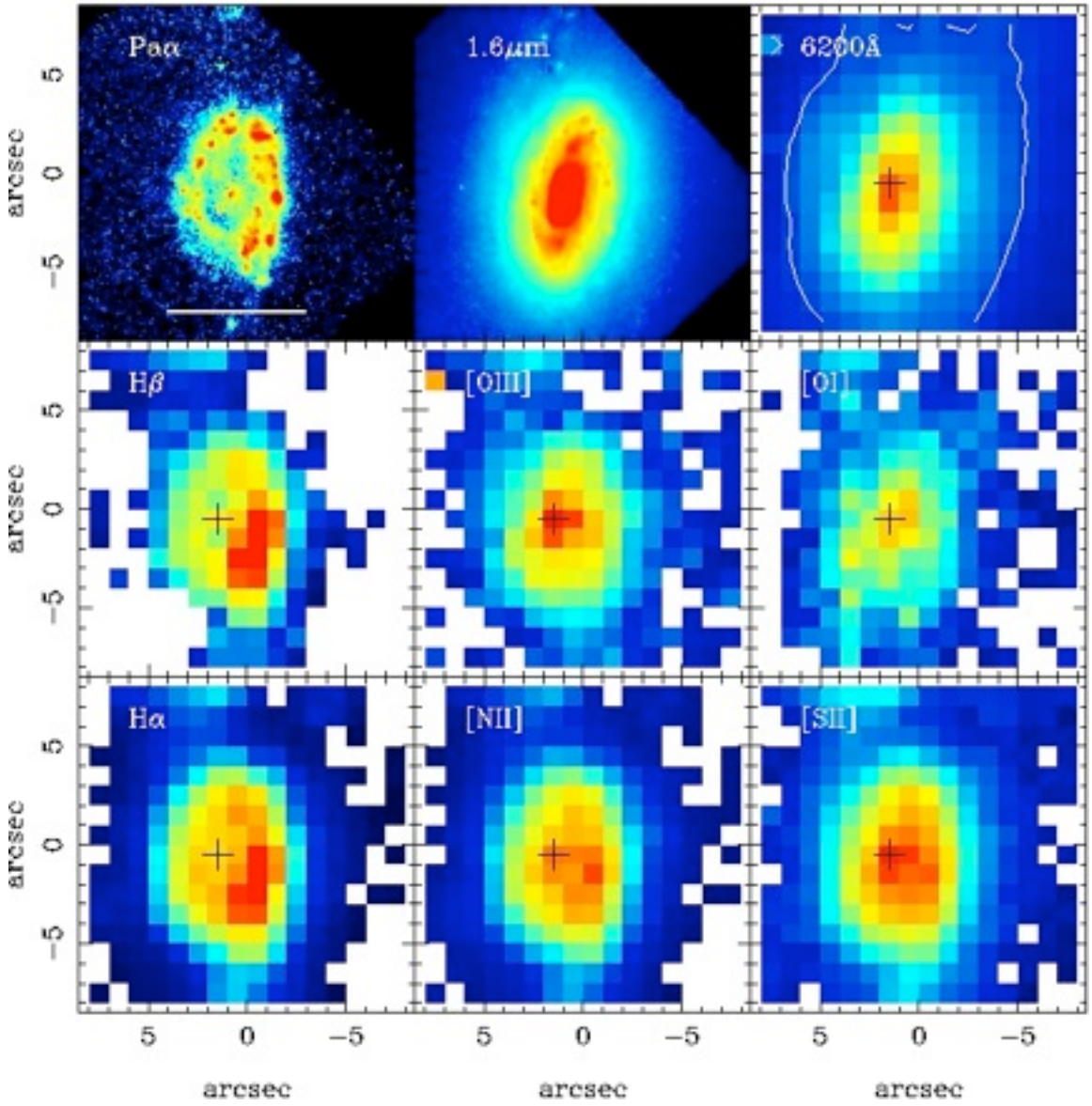
PMAS Observations

NGC23



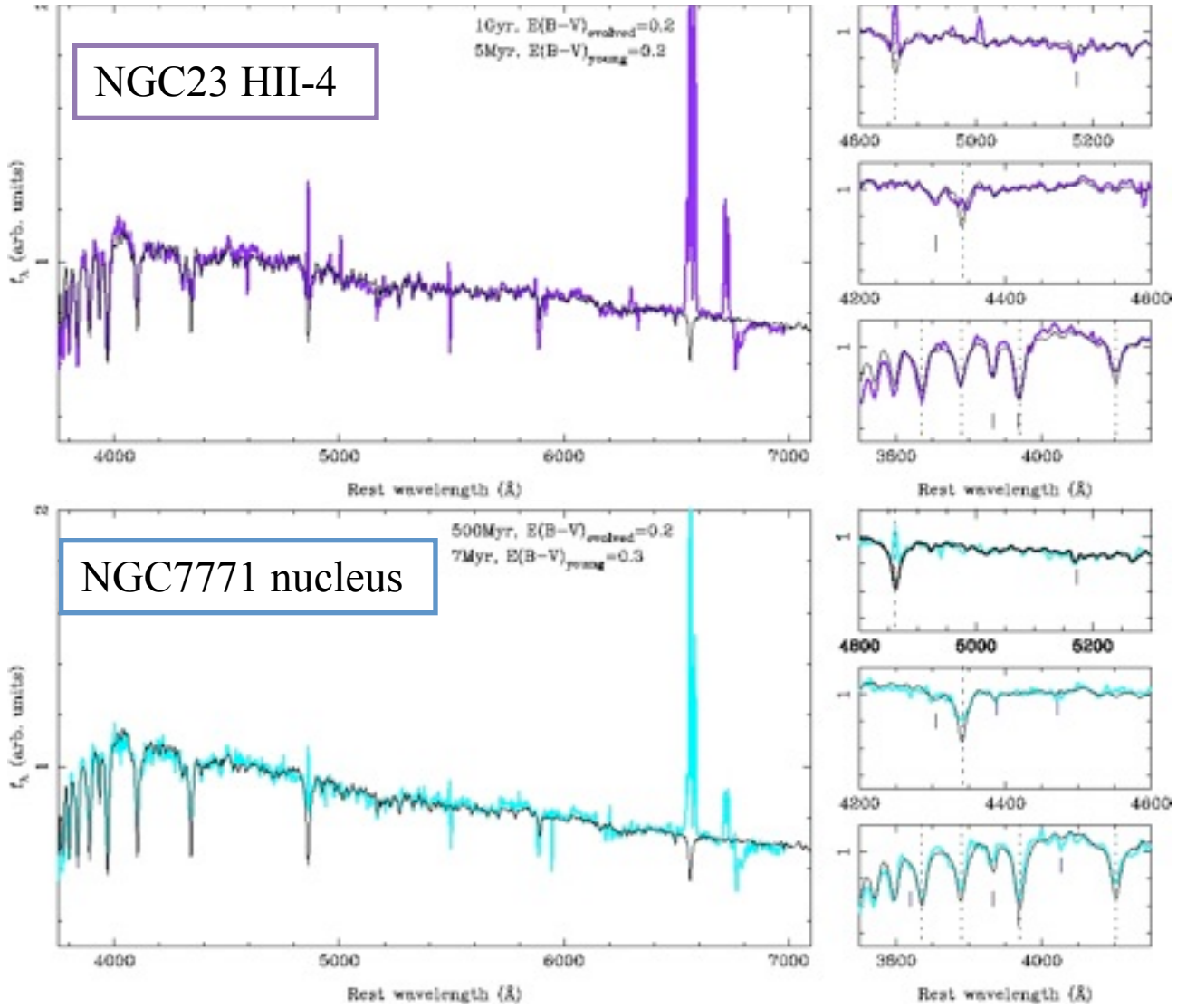
Sample: 11 LIRGs at distances <75Mpc from the flux and distance limited sample of Alonso-Herrero et al. (2006)

Spaxel: 1¨
FoV: 16¨× 16¨
FoV: central few kpc
Grating: V300
Spectral range: 3800-7200Å
All galaxies except NGC7771 observed with one pointing

Collaborators: M. García-Marín, J. Rodríguez Zaurín, A. Monreal-Ibero, L. Colina, S. Arribas, A. Labiano, J. Alfonso

Alonso-Herrero et al. (2009)

Spatially resolved Stellar Populations



Modeling with two stellar populations formed in instantaneous bursts and generated with BC03 models:

Ionizing <20Myr

Evolved 100Myr-10Gyr

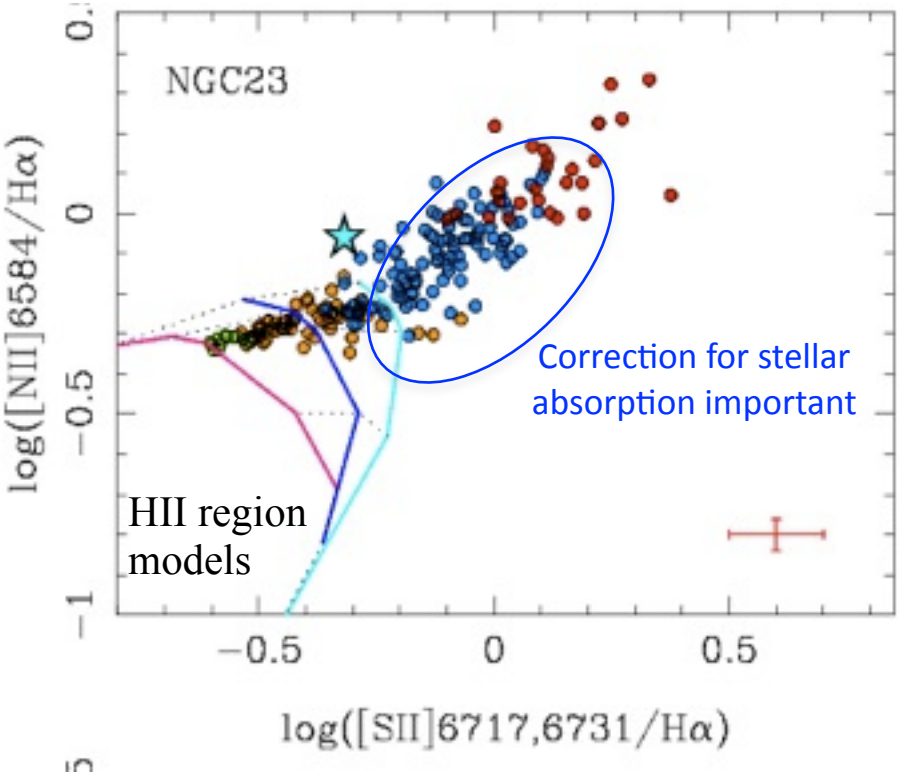
Important contribution to optical light of ionizing stellar populations with extinctions

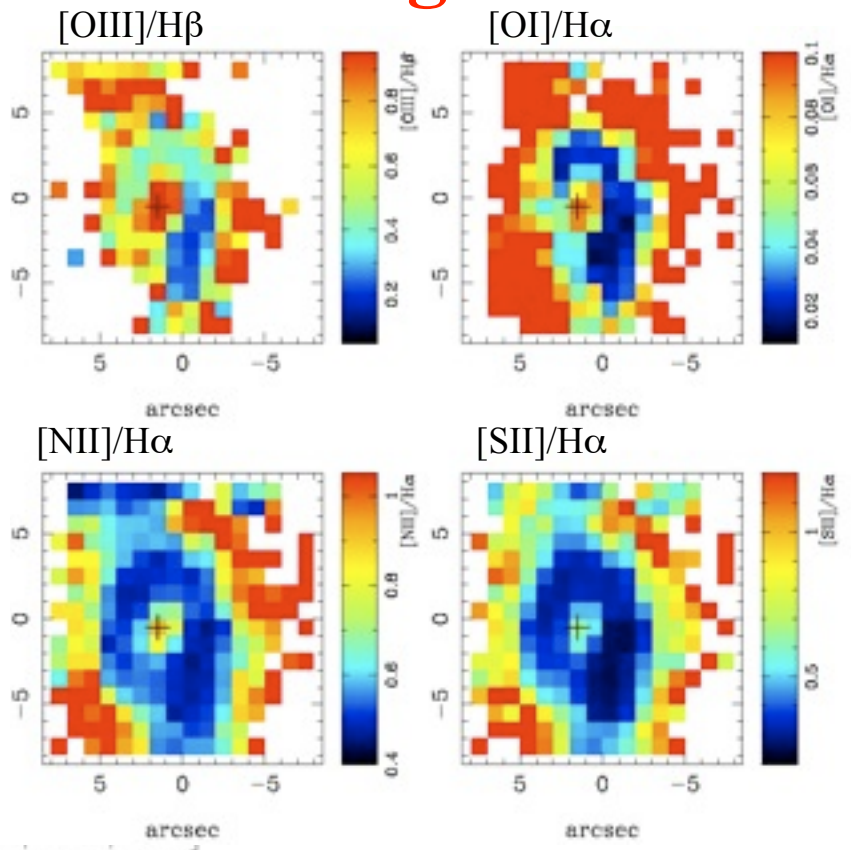
$E(B\text{-}V)_{young}$=0.3-1.5

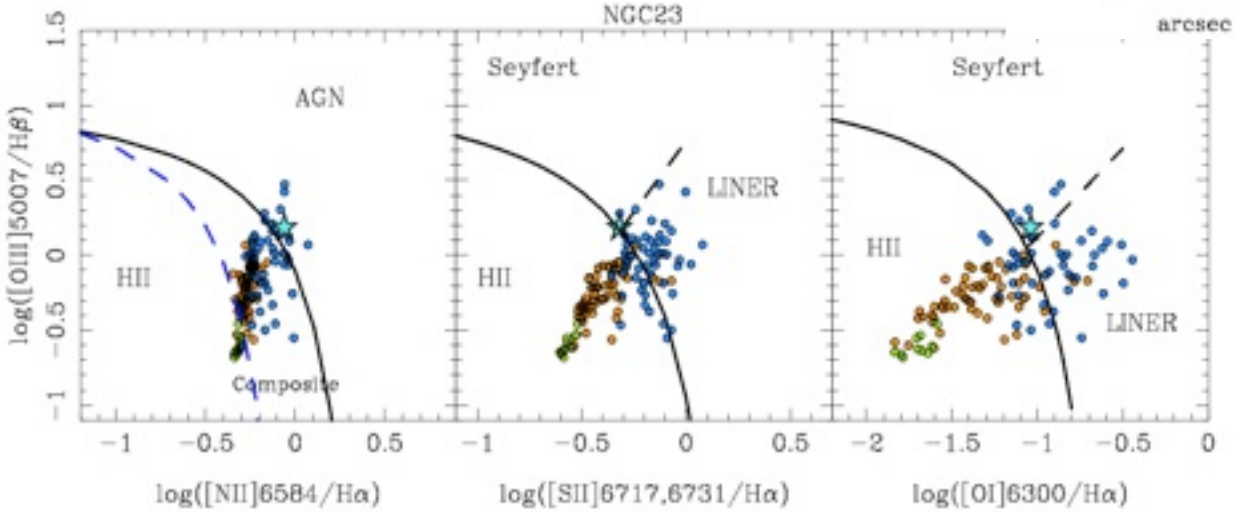
Most regions evolved stars with ages ≥1Gyr

Alonso-Herrero et al. (2010)

Excitation conditions of the gas



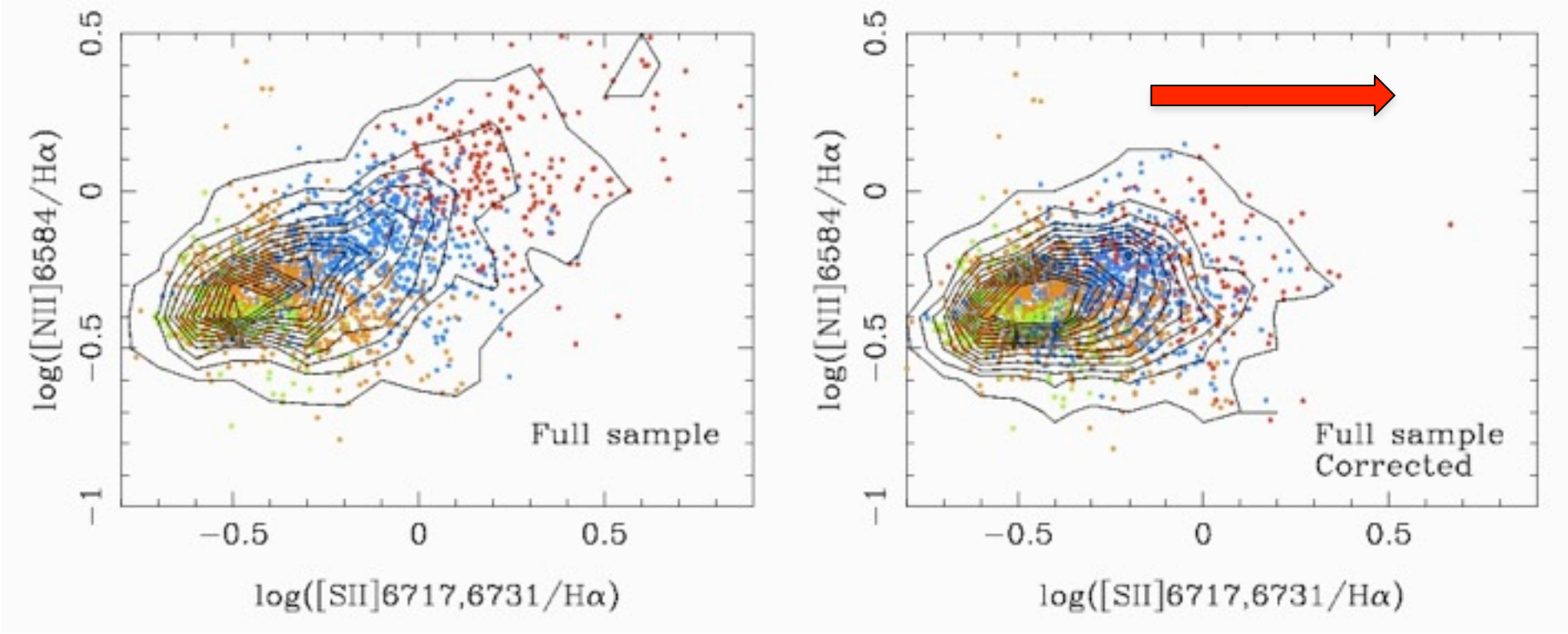




Line ratios are not corrected for Hα stellar absorption

Alonso-Herrero et al. (2010)

Diffuse Emission in LIRGs



Even after correction for stellar absorption about 25% of spaxels have log [SII]/Hα>-0.2 ➔ not explained by ¨standard¨ HII region ionization

Other mechanisms: slow shocks, ionization by leaking photons

Diffuse emission < 70% within central few kpc

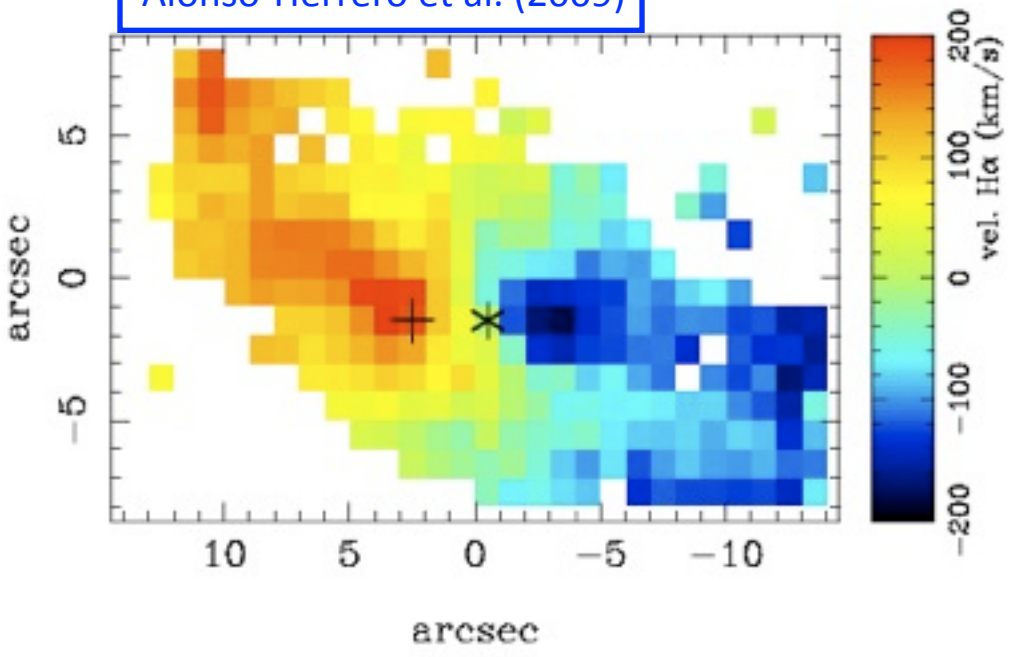
Ionized gas kinematics

PMAS observations cover the central 3-6kpc of the galaxies.

Relatively well-ordered Hα velocity fields similar to those of disk galaxies and consistent with rotation. Note most galaxies $\log(L_{IR}/L_{\odot})<11.40$ and look like spiral galaxies

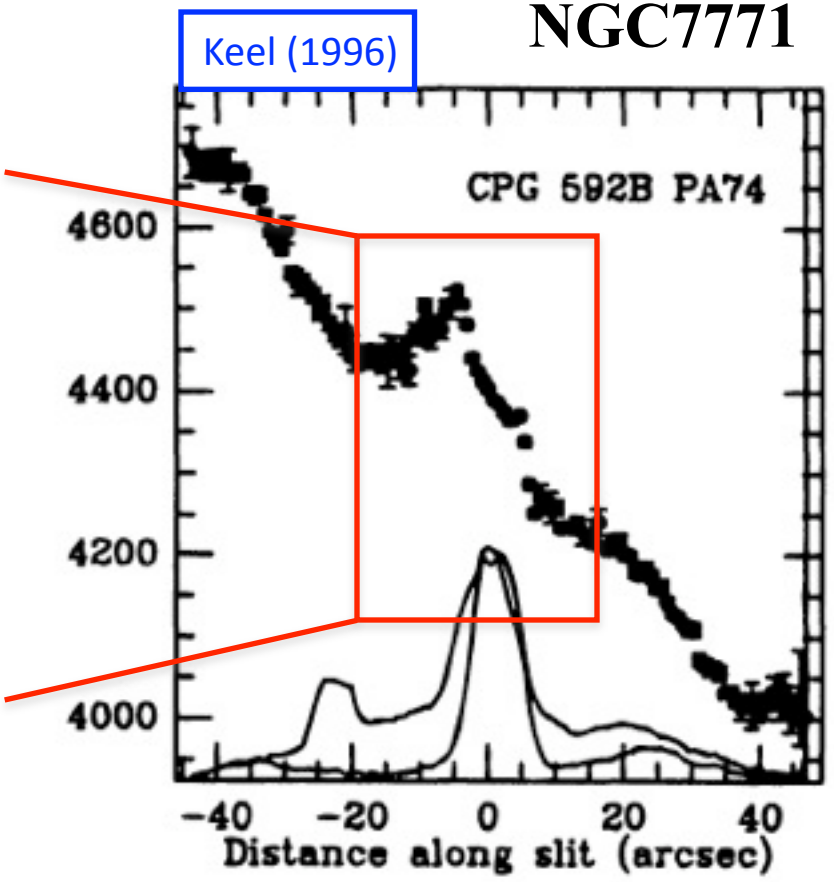
Few galaxies show central peculiarities

Alonso-Herrero et al. (2009)



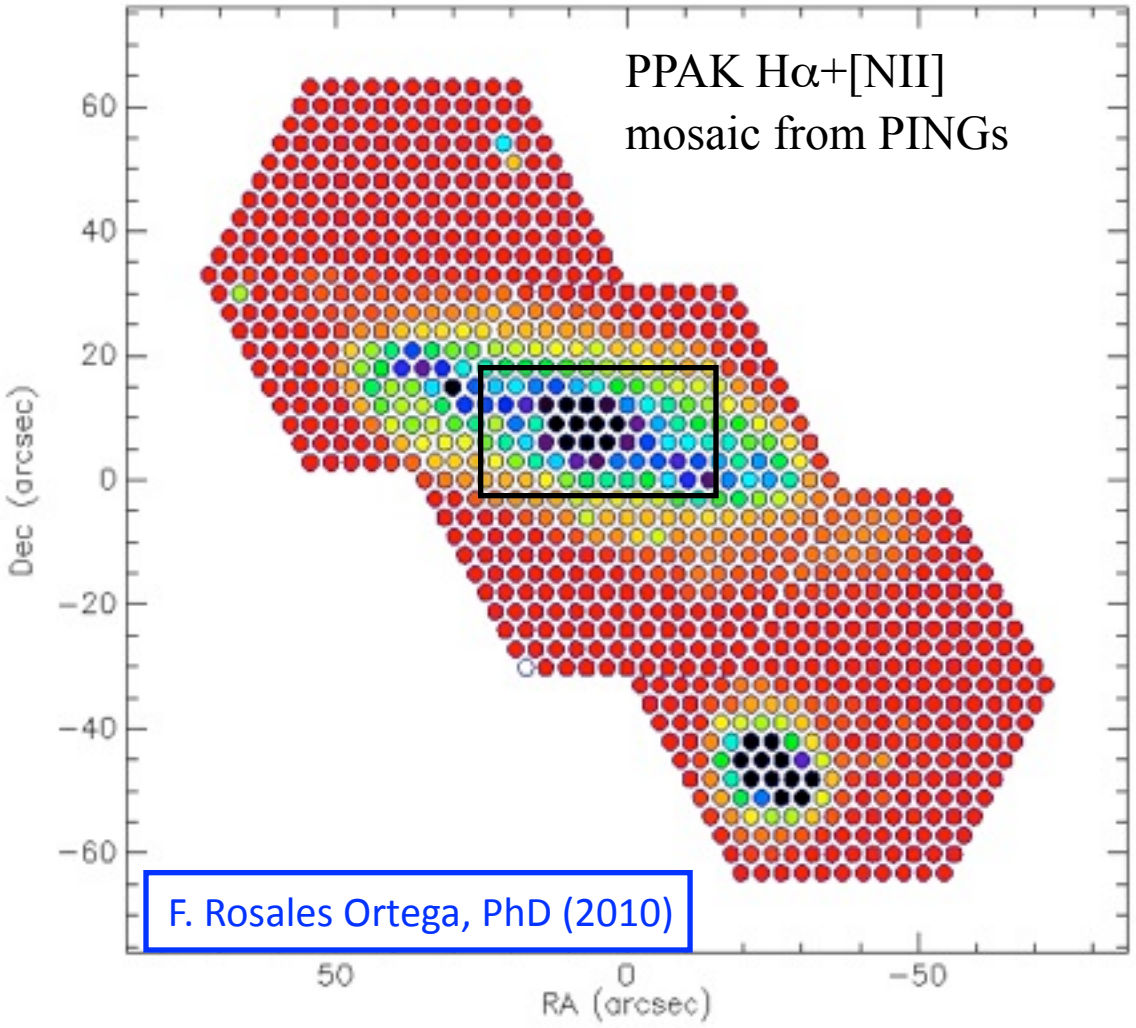
Keel (1996)

NGC7771



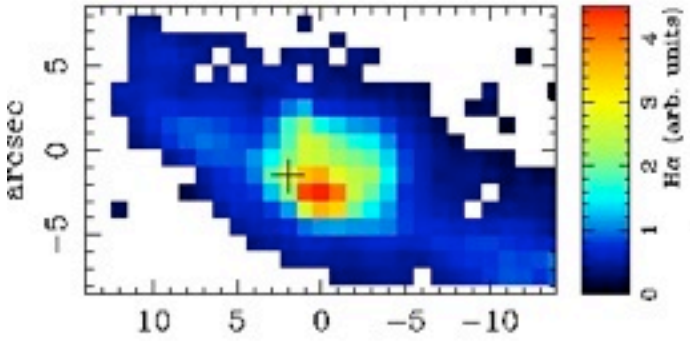
“Near Future”

NGC7771 + NGC7770



F. Rosales Ortega, PhD (2010)

PMAS Hα mosaic



Alonso-Herrero et al. (2009)