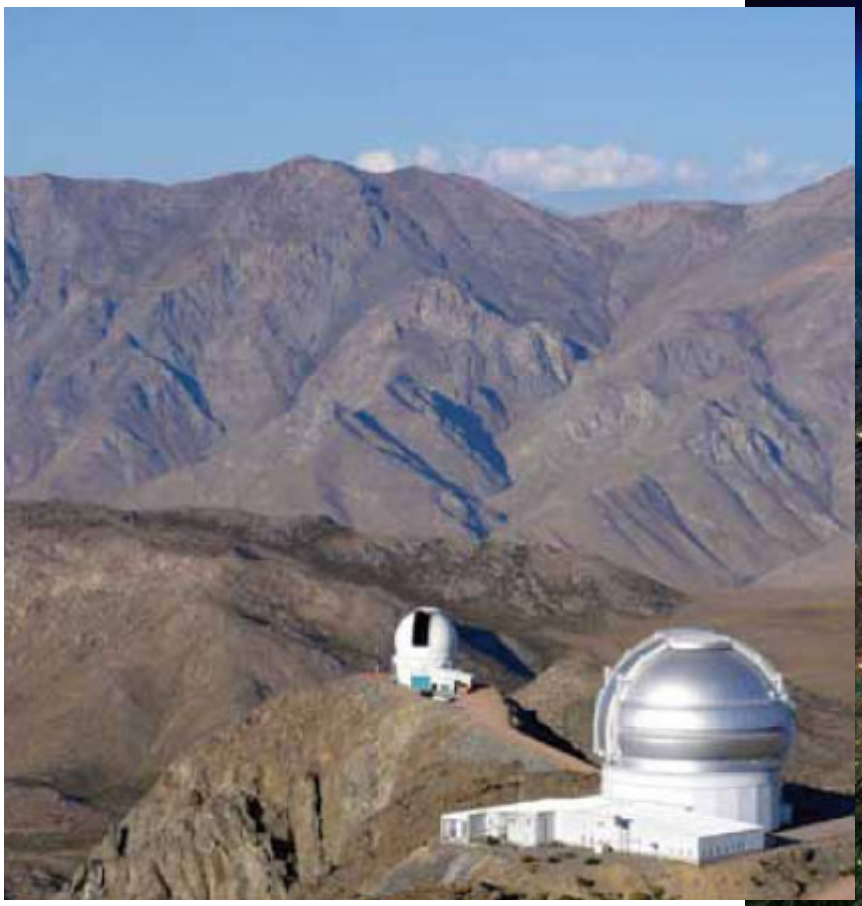
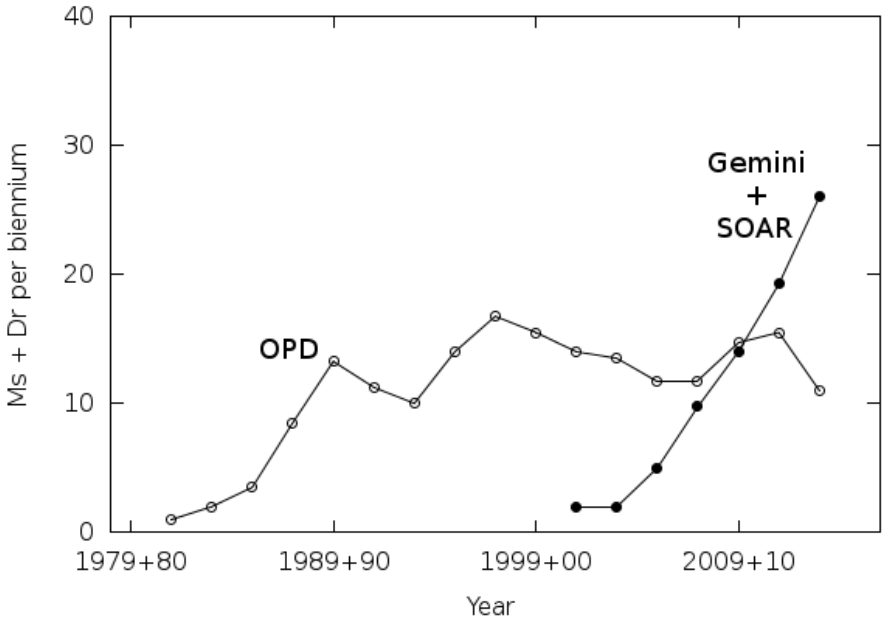
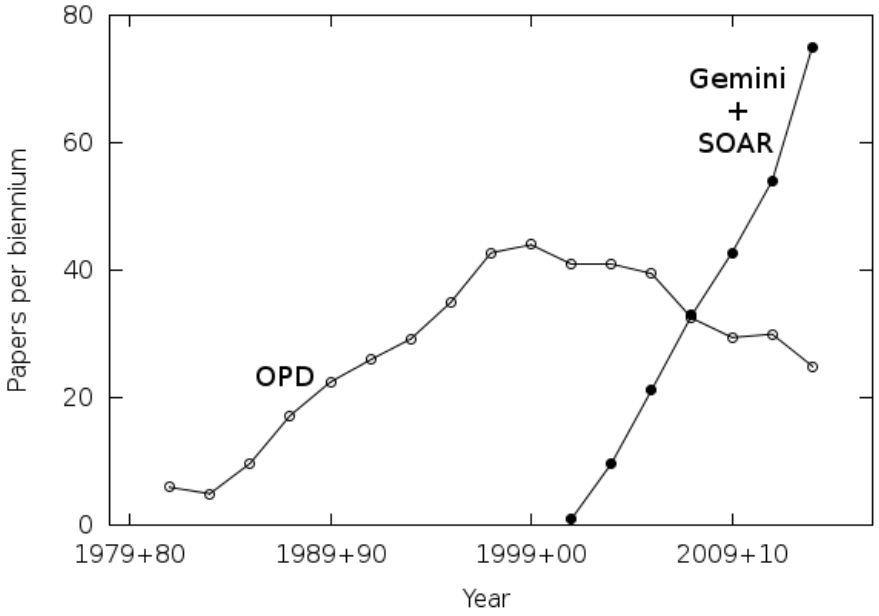
Brazil´s Highlights and Perspectives with Gemini (Cypriano+Storchi-Bergmann)



Science with Gemini

Gemini revelevance for the Brazilian optical astronomy is paramount!





Oversubscription ~ 2-3

Science Highlights

The top 10 most cited Gemini papers with Brazilian based first authors

- Riffel, R. A.+08 "*Mapping of molecular gas inflow towards the Seyfert nucleus of NGC4051 using Gemini NIFS*"
- Cunha, K.+06 "*Chemical Evolution of the Galactic Bulge as Derived from High-Resolution Infrared Spectroscopy of K and M Red Giants*"
- Storchi-Bergmann+09 "*Feeding versus feedback in NGC4151 probed with Gemini NIFS - I. Excitation*"
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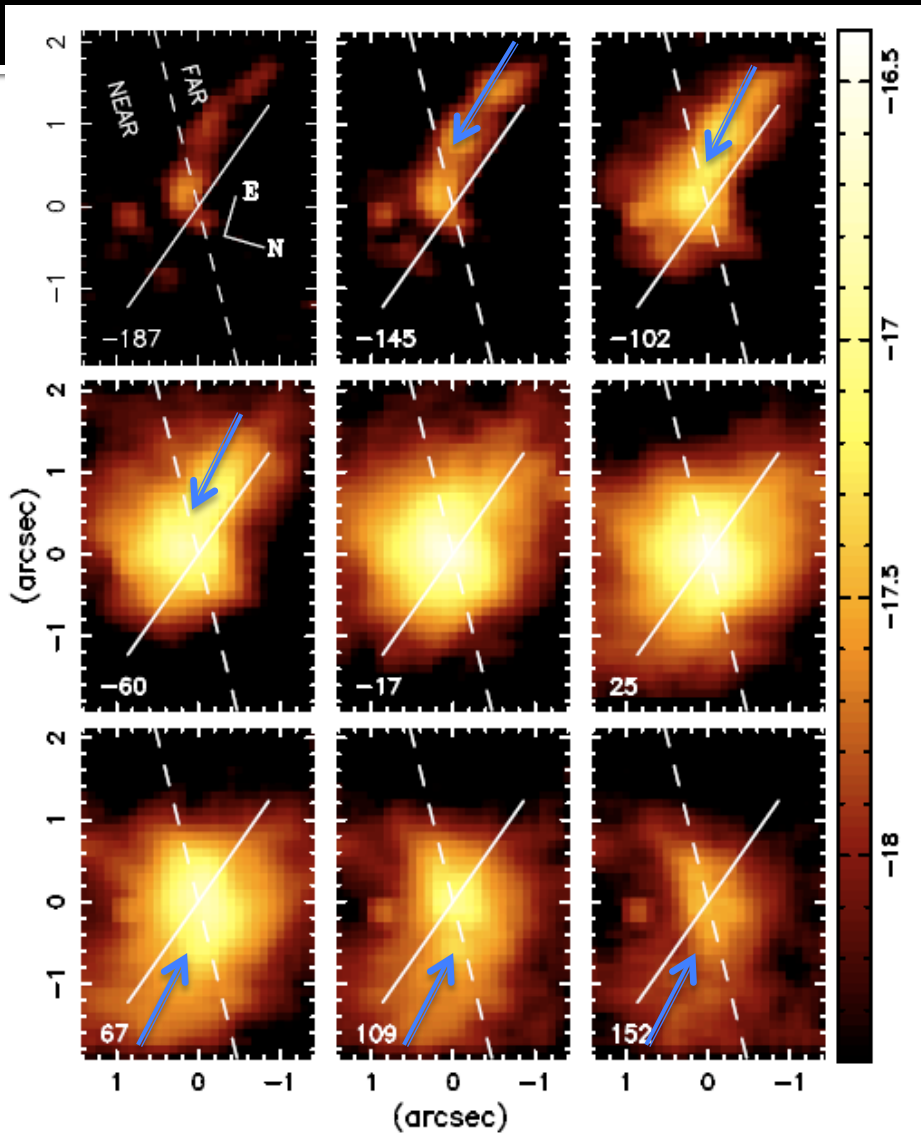
Riffel et al. 2008: H2 inflow in NGC4051

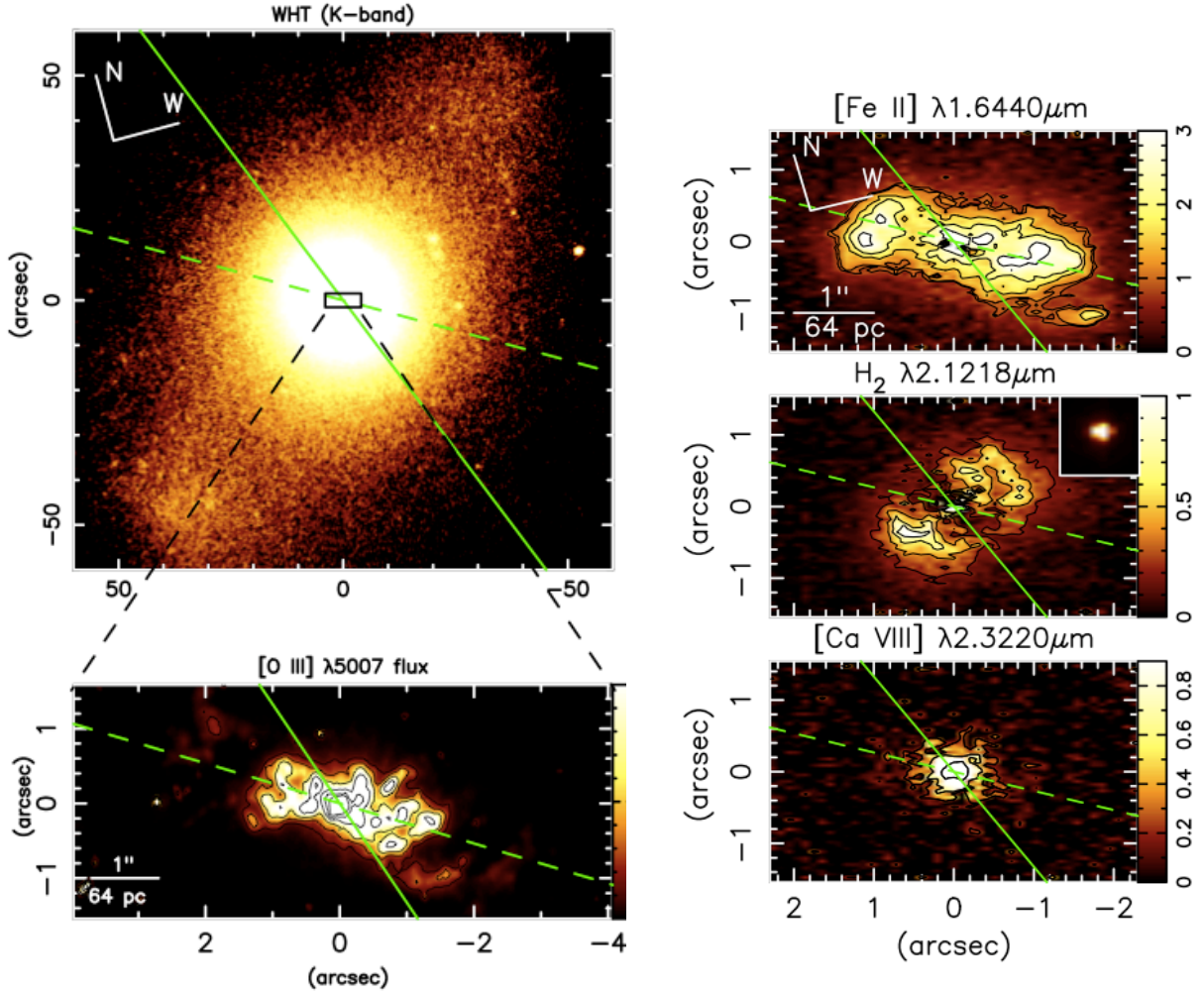
- Major axis from stellar kinematics
- 2 spiral arms within inner 100pc
- Blueshifts in far side, redshifts in near side. If gas is in the plane -> inflow
- "Hot"(2000K) H2 mass ≈ 66 $M_\odot$
- Inflow rate ≈ 4 x 10^{-5} $M_\odot$ yr^{-1}
- Cold molecular gas: ≈ 10^{5-7} larger (Dale+05, Müller-Sanchez+11, Mazzalay+12, ALMA) ->

Molecular gas mass ≥ 6.6 x 10^6 $M_\odot$
Mass inflow rate ≥ 4 $M_\odot$ yr^{-1}



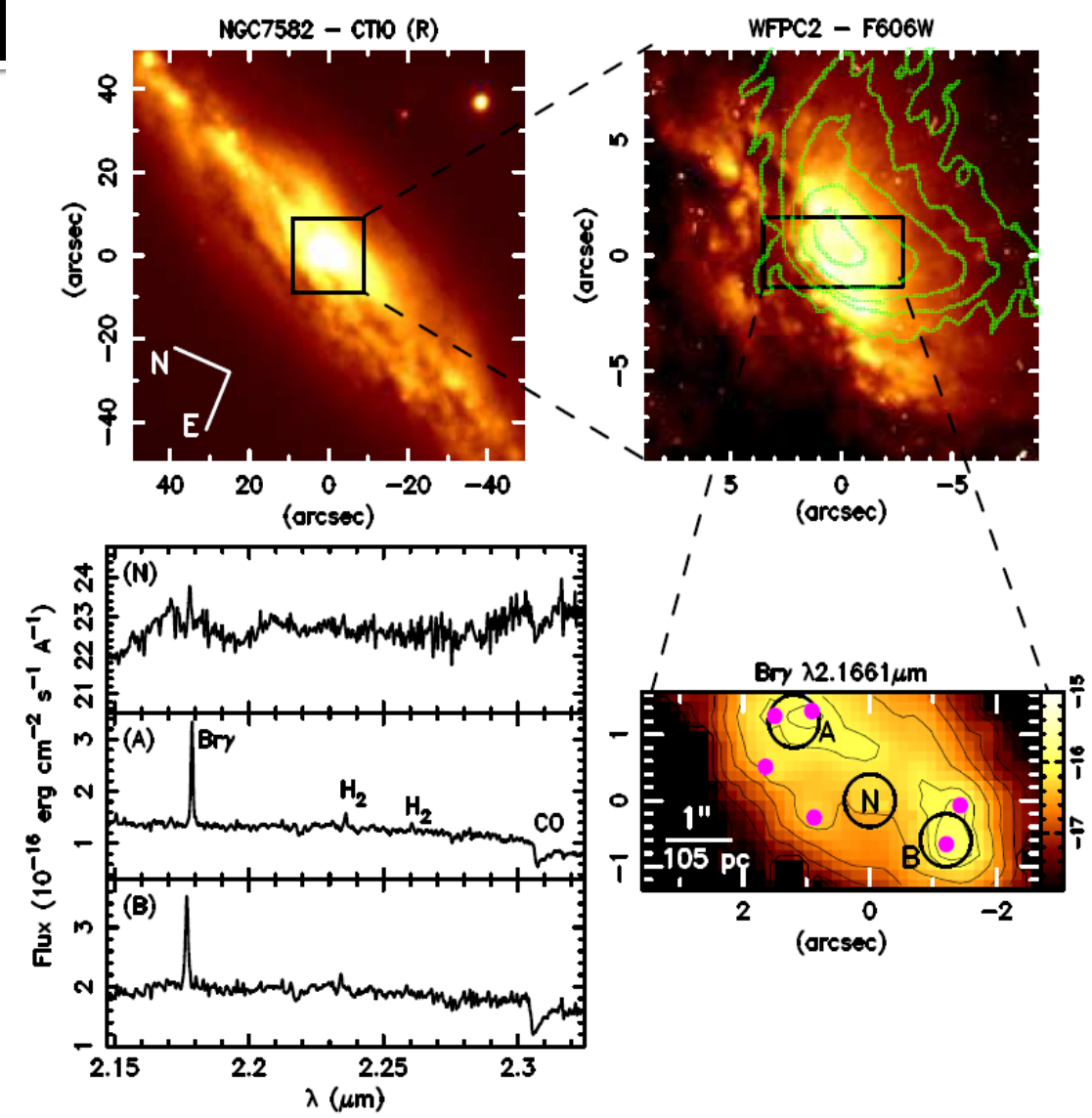
Storchi-Bergmann et al. 09, 10: **Outflow and inflow in NGC4151**

- SABab, Sy 1.5
- FOV= 560 pc x 210 pc
- 0.1″: ~ 7 pc
- [FeII] 1.64μm: ioniz. cone + outflow, 100 pc, N_e ~4000 cm^{-3}, T_e~15000K
- Mass outflow rate: ~ 2 $M_\odot$ yr^{-1}
- H_2 2.122μm: inflow along bar; 50 pc, T_e~2000K



Riffel et al. 09: AGN+ Starburst in NGC 7582

- GNIRS K band;
- FoV: 660 x 315 pc²
- 0.5″~50 pc
- Brγ: AGN outflow + 200 pc star-forming ring
- Accretion rate/star formation rate= 0.0026 (~M_{BH}/M_{bulge})
- Hot H_2: ~620 M_{sun} (cold: > 6 x $10^7 M_{sun}$)
- Stellar kinematics: low-sigma ring



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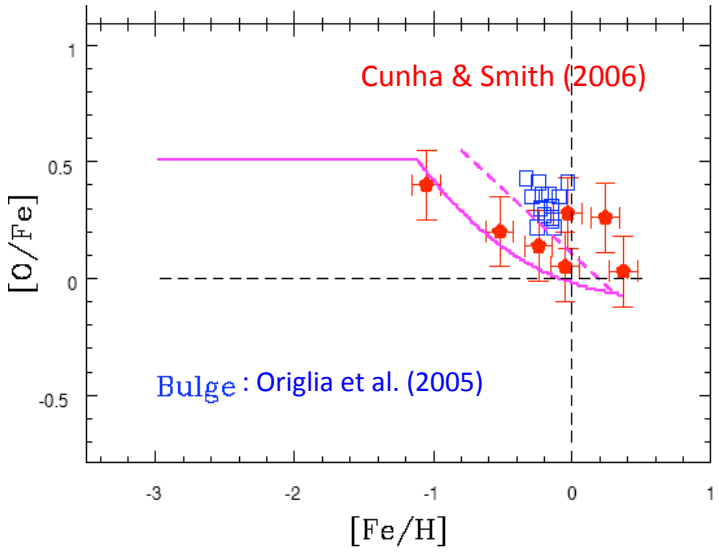
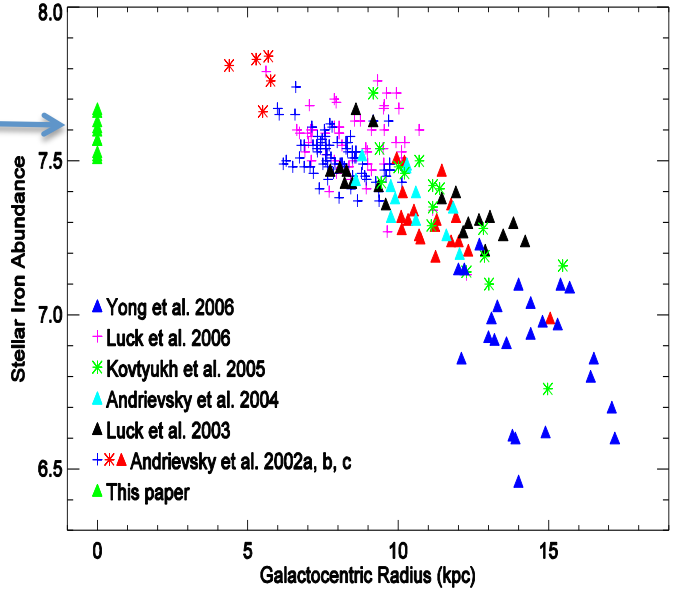
Using Gemini South/ Phoenix to probe the Galactic Center & Galactic Bulge

Infrared observations are crucial due to heavy extinction



- Early results for the Galactic Bulge from Phoenix spectra at 1.5 micron
- Small sample but covering metallicity range (Fe)
- Abundances from OH, CN, CO and atomic lines (e.g. Fe I)

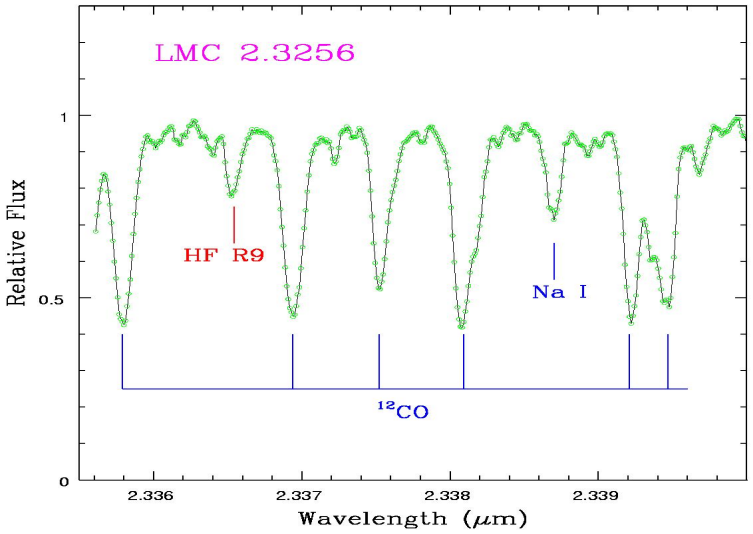
Cunha et al. (2007)



- Chemistry of Central Cluster
- Stars within a few pc from the black hole in the Galactic Center
- Finds solar metallicity for the Galactic center; not an extrapolation from the Disk

Using Gemini South/ Phoenix to probe The Origins of Fluorine

(K=12; Texp= 1.5h)

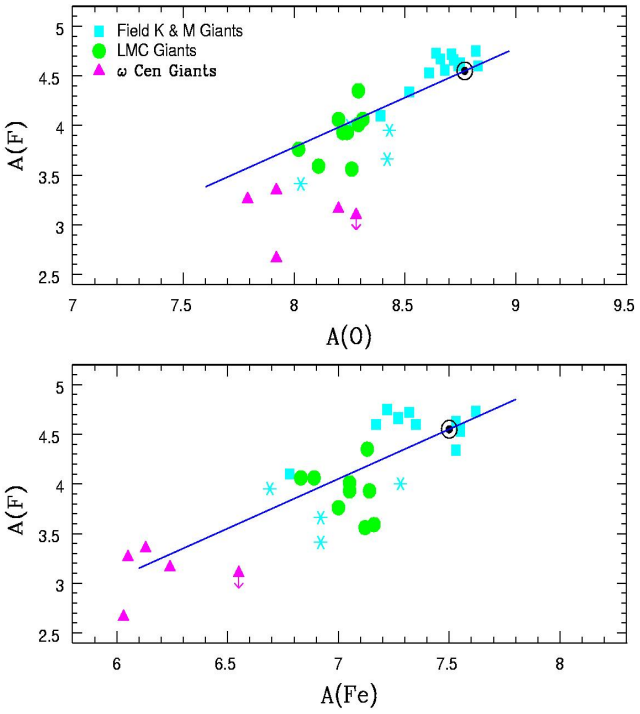


Gemini South + Phoenix (R=50,000) spectrum of red-giant in the LMC showing the HF(1-0) R9 line.

- Origins of element Fluorine still unknown

- Possible sources of fluorine in the Galaxy:

1) Massive stars at the Wolf-Rayet phase
2) Low or intermediate mass stars : AGB stars
3) Supernovae Type II



Cunha et al.

Goal: Probe the behavior of Fluorine with metallicity (Fe) and other elements abundances such as oxygen (produced in SNe II) in the Galaxy and the LMC and SMC.

Phoenix can provide spectra at 2.3 micron; this lambda range is not probed by current surveys (e.g. the APOGEE Survey)

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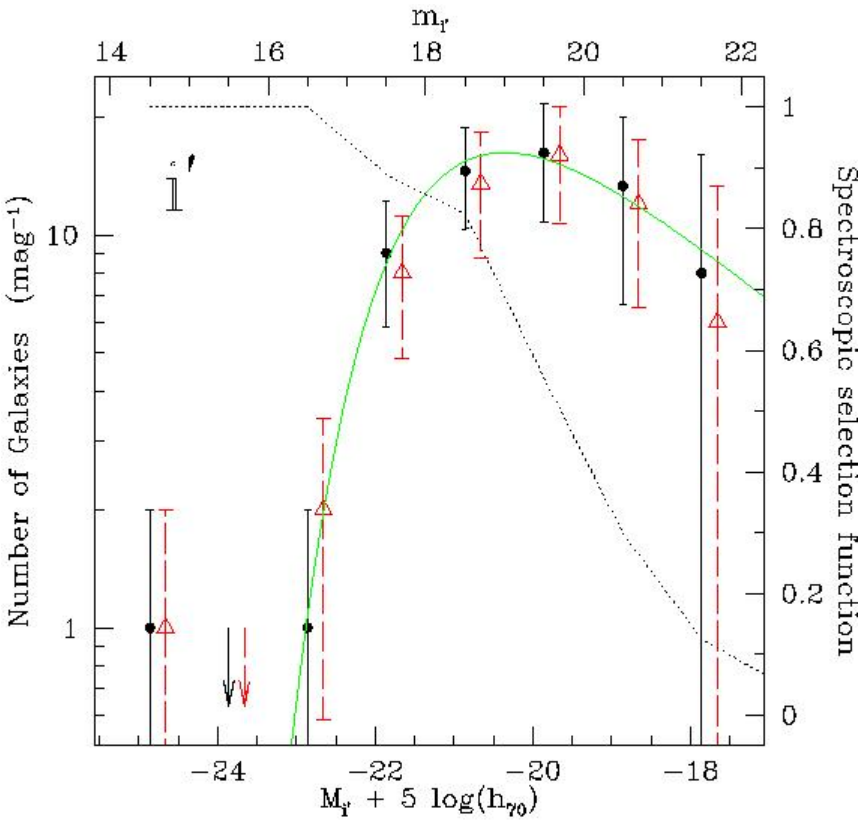
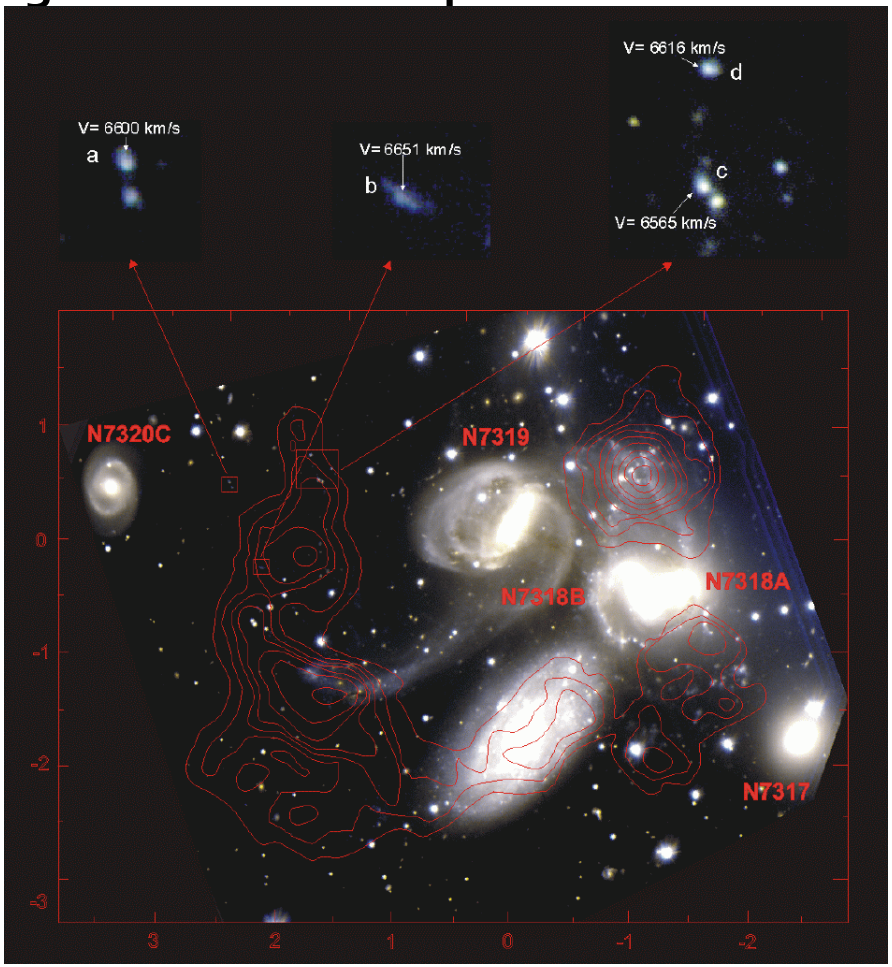
Mendes de Oliveira et al. 04, 06: Fossil & Compact Groups

Low-resolution optical spectroscopy and imaging with GMOS

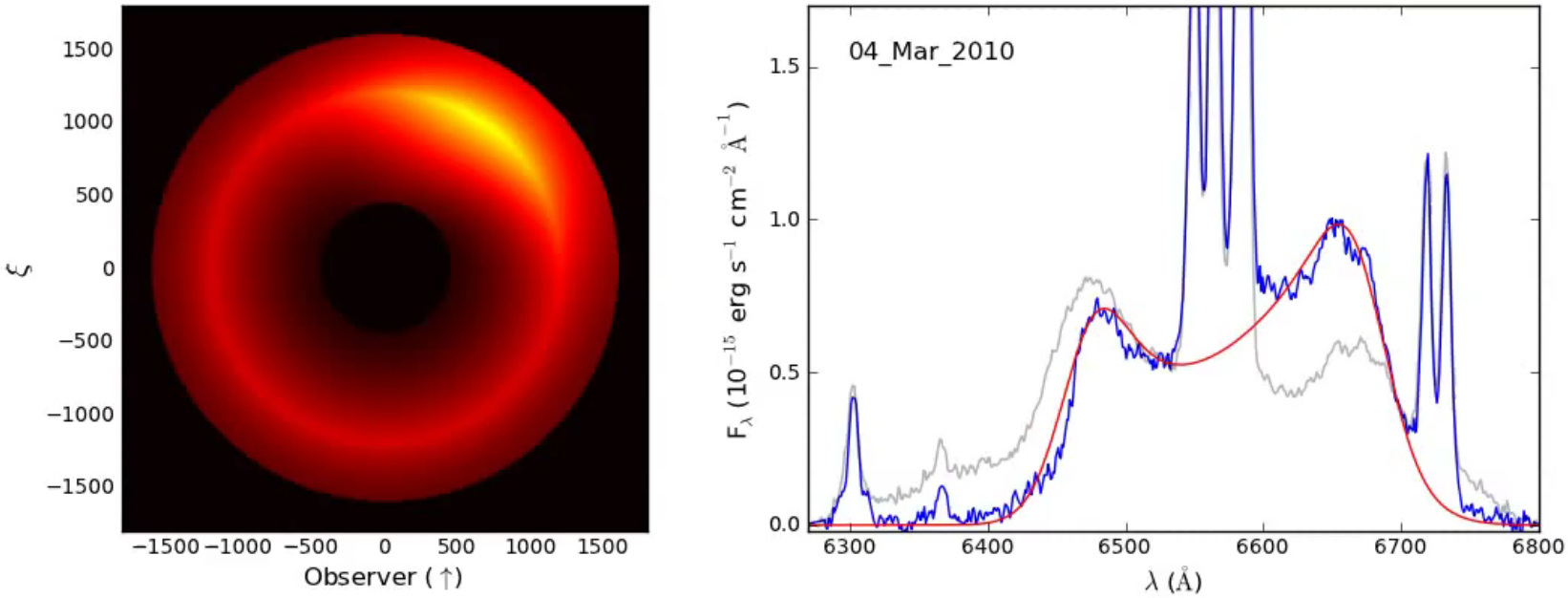
First reliable luminosity functions and dynamical masses for fossil groups & clusters



Discovery of star formation outside galaxies in the Stephan´s Quintet



Shimoia et al. 12, 15, poor weather: **Monitoring double peaked Hα emission in NGC1097**



Accretion disk model compared to profiles at different epochs

Other projects:

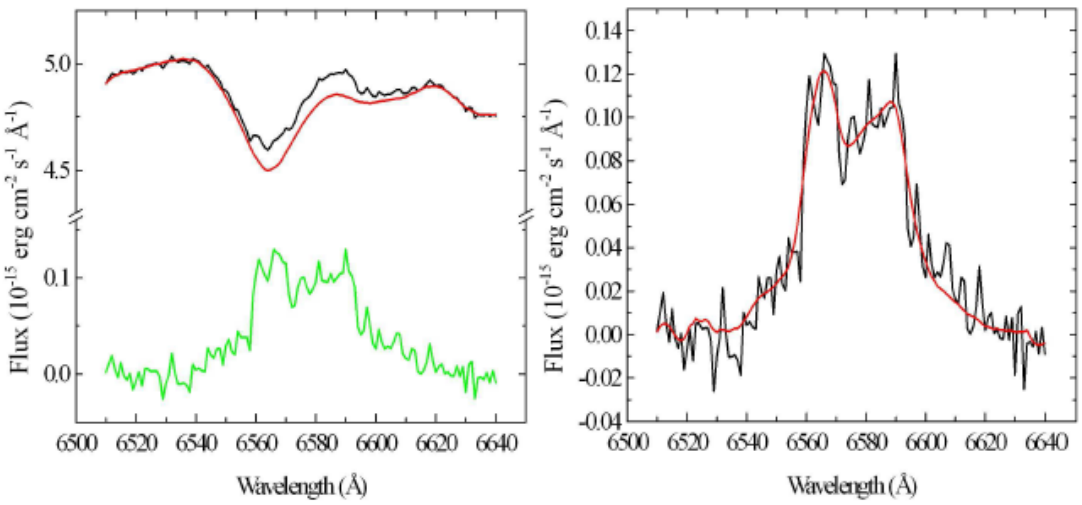
- Nicolaci da Costa (NIFS): DES Supernova Cosmology
- Almeida (GRACES): Exoplanet candidate
- Overzier (GMOS-MOS): Densets structures in COSMOS field (z~2-3)
- Sales et al.: GMOS-IFU and long-slit of OH Megamaser gals.; mid-IR spectra of AGN
- Gonçalves et al.: The Chemical Evolution of the Local Group of Galaxies constrained by PNe and H II regions
- Rodrigues et al., Pastoriza et al.: Abundances, excitation and kinematics of interacting galaxies
- Telles et al.: Kinematics, excitation, abundances of dwarf star-forming galaxies
- Rogério Riffel et al.: Near-IR spectroscopy of Palomar AGN
- Faúndez-Abans, Krabbe et al.: Kinematics of peculiar (ring) galaxies

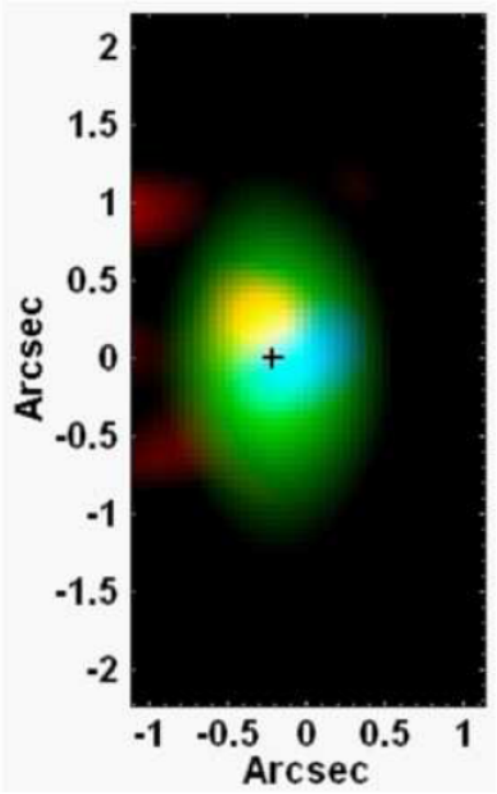
Brazilian LLP1: DIVING^{3D} - Deep IFS View of Nuclei of Galaxies (Steiner, Cid Fernandes, Menezes +: GMOS IFU - Palomar sample)

PCA technique, e.g. NGC 3115 – an off-nuclear type 1 AGN

Menezes, Steiner and Ricci 2014 (ApJ Lett. 796, L13)

- a) Hα residuals: broad line from AGN
- b) AGN (yellow): 0.3"~14 pc from stellar nucleus (blue) and photometric center – PCA technique





Brazilian LLP2: NIFS Survey of Feeding and Feedback in nearby Active Galaxies (Nearby BAT AGN sample)

- Goal: map and quantify inflows, outflows and stellar population on 10-100 pc scales in a complete distance-limited sample of nearby AGN

- Team: AGNIFS – AGN Integral Field Spectroscopy

Thaisa Storchi Bergmann (PI)
Rogemar A. Riffel
Rogério Riffel
Marlon Diniz
Astor Schönell Jr.
Natacha Z. Dametto
Daniel Ruschell Dutra
Jaderson Schimoia

Gemini/Brazil past & present
"What capabilities do you value the most?"

Answer based on past use

- GMOS: MOS & IFU modes in particular
- NIFS & GNIRS: NIFS+AO in particular

Demands so far unfulfilled by Gemini

- High-resolution spectroscopy for stellar astrophysics -> high demand for GRACES in the present semester

Gemini/Brazil future

- Explore Gemini image quality with AO:
  - "GSAOI like" for the infrared
  - GLAO for the optical
  - Use with Optical Integral Field Spectroscopy