Brazilian Large and Long Program (BrLLP) LP002
Progress Report - September 2018

Title: AGNIFS - NIFS survey of feeding and feedback processes in nearby Active Galaxies

Thaisa Storchi Bergmann (PI, IF-UFRGS, Instituto de Física, Univ. Federal do RGS)
Rogemar André Riffel (UFSM, Universidade Federal de Santa Maria)
Rogerio Riffel (IF-UFRGS)
Marlon R. Diniz (Pos-doc at UFSM, supervised by Rogemar A. Riffel)
Astor Joao Schoenell Jr. (IFRarr-RS)
Natacha Z. Dametto (PhD thesis, advised by Rogério Riffel)
Luis Gabriel Dahmer Hahn (PhD thesis, advised by Rogério Riffel)
Marina Bianchin (UFSM, PhD thesis, advised by Rogemar A. Riffel)

1. Executive summary

We have been awarded 82.5 hours (spread over 6 semesters) to complete NIFS+ALTAIR observations in the J and K bands of the inner few hundred parsecs of a distance limited sample of 20 nearby Seyfert galaxies drawn from the Swift-BAT 60-month catalogue and selected to have 14-195 keV luminosities larger than $10^{41.5}$ erg/s, redshifts z<0.015 and being accessible to NIFS (-30°<δ<73°). Our goal is to map the ionized and hot molecular gas distributions and kinematics, as well as the stellar population and kinematics in order to answer the following questions: (i) How much mass is available for accretion; (ii) what mechanisms bring gas to the environs of the SMBH and (iii) what are the mass inflow rates? (iv) How do outflows interact with the interstellar medium, (v) what are the mass outflow rates and kinetic power? (vi) Can the outflows strip the ISM away from around the BH? (vii) What is the role of star formation in the process? Can we find signatures of recent star formation in the vicinity of the AGN -- a signature of co-evolution of the bulge and SMBH? (viii) How are the measured properties related to the luminosity of the AGN?

In order to complete the observations of the sample of 20 nearby Seyfert galaxies, we need to observe 16 galaxies in the J and K bands plus one galaxy, NGC2110, only in the J band, as we have previous NIFS observations of 4 galaxies of the BAT sample. We have estimated we need 5 hours per galaxy, thus a total of 82.5 hours for the completion of the observations, which we estimated could be observed in 6 semesters: 2015A, 2015B, 2016A, 2016B, 2017A, 2017B. Unfortunately, due to the problem that happened with Altair in 2016B, we have had no observations in 2017A, 2017B and 2018A, even though we were awarded the time. In 2018B, we were awarded 17.5 hours to observe 5 objects, and received the data for 1 already. In summary, we received data only for 7 objects and are thus still missing observations of 9 objects. If we receive data the present semester for the next 4 for which we have been awarded the time, plus for the next 5 targets in 2019A we can conclude the project.

Project site and Data Release: We have built a site with the results of the project obtained so far: https://sites.google.com/view/agnifs. We are planning to make available, via this site, two data releases (DR) containing reduced data cubes: the DR1 is planned for when 75% of the observations are concluded, while DR2 will be released when the full sample (or at least 90% of it) is observed. But if desired by the NTAC, we can make available right away to the Brazilian Astronomical community the reduced data cubes of 6 galaxies observed with the LLP, e.g. via e-mail contact with the PI. The raw data is already available in the Gemini archive.

2. Status of the project:

We have kept the histograms below from the last reports to emphasize the need of more data for us to be able to conclude the project, as we have so far only 37.5% of the data we have requested in the LLP2.

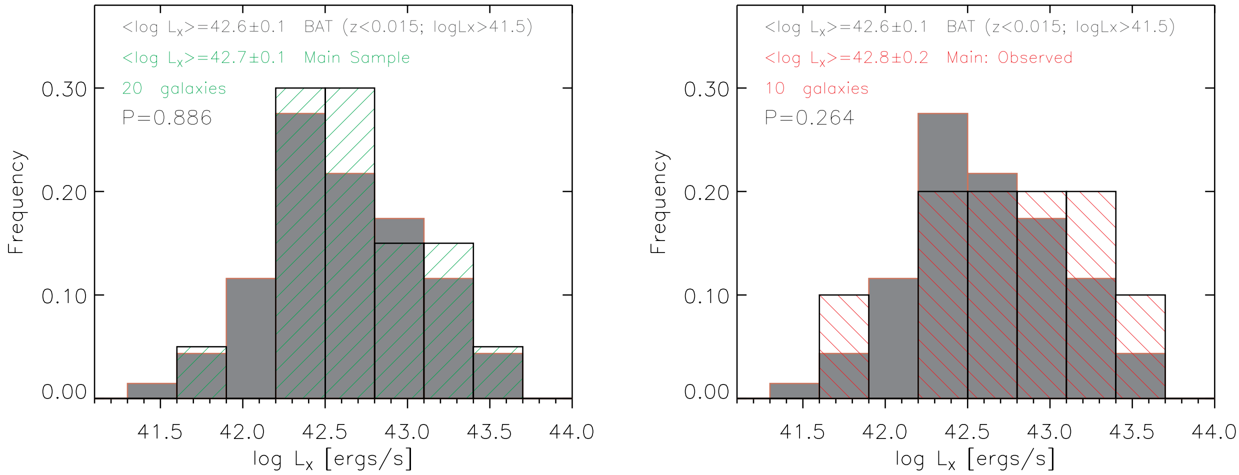

Figure 1: Distribution of the BAT-AGN sample in terms of the X-ray luminosity of the AGN (filled histogram) as compared with the distribution for the whole LLP sample of 20 AGN (green hatched histogram, left panel) and with the distribution of the 10 AGN (red hatched histogram, right panel) so far observed (6 from LLP2 and 4 from previous observations).

Most of the raw data are already available in the Gemini Science Archive as public (except for the last galaxy recently observed, NGC1125). Considering the final reduced data, the link in the website of the project (https://sites.google.com/view/agnifs) points to the Data Release 0 (DR0), which includes the J and K-band cubes of 9 galaxies (most from previous observations but that obey the criteria for the scientific goals of the project, and thus included in the total sample).

3. Progress of the work over the last year 2017-2018:

In September 24th, 2018, Natacha Zanon Dametto, presented her PhD Thesis: "Estudo das populações estelares em galáxias ativas no infravermelho próximo: o caso de NGC 4303"

In July 2018, the following paper was re-submitted for publication after revision requested by the referee: Schönell et al. 2017: "*Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: III - Gas distribution and excitation".*

In 2018A, Marina Bianchin has joint the project as a PhD student at UFSM.

In 2018A, the following paper was published: Riffel et al. 2018, MNRAS, 474, 1373: *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: II -The sample and surface mass density profiles.*

In 2017B, two PhD theses were presented based on data of the LLP.

1. Diniz,M. R., 2017: "Estudo de populações estelares em galáxias ativas a partir de cubos de dados no infravermelho próximo", UFSM. Supervisor*:* Rogemar A. Riffel

2. Schonell, A. J.**,** 2017: "Estudo da alimentação e Retro-alimentação de núcleos ativos de galáxias a partir de observações no infravermelho próximo", UFRGS. *Supervisora*: Thaisa Storchi-Bergmann

The following papers are still "in progress":

(1) *2D Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: IV – Gas emission and Stellar Populations in NGC2110,* by Diniz, M. R. et al.; this paper presents a study of the gas excitation and kinematics, as well as the distribution of the stellar populations in NGC2110. This paper is being finalized and is about to be submitted.

(2) *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: V - Resolved 2D stellar populations in the inner kiloparsec,* by Diniz, M. R. et al.; this paper applies the methodology developed in the paper above and contains many of the results of Diniz PhD Thesis. More work on the spectral synthesis is needed for some galaxies.

(3) *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: VI- gas kinematics,* by Bianchin, M. et al.; this paper presents and discuss the gas kinematics of six galaxies. It will be part of the Marina Bianchin PhD Thesis.

(4) *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: VII - 2D stellar population of the inner 500 pc of NGC 4151*, by Riffel, Rogerio et al.; this paper provides the mapping of the stellar population ages and nuclear continuum of this well known and nearby Seyfert 1.5 galaxy

(5) *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: VII - gas excitation and coronal line emission,* by Schonell, A. et al.; this paper presents and discuss the gas excitation and origin of the high ionization gas.

(6) *Probing the AGN-SB connection in the Near-Infrared*, by Dametto et al.;

(7) *2D Panchromatic stellar populations in Seyfert galaxies*, by Hahn et al.: this paper will be the main paper of Luis D. Hahn Thesis, to be presented in 2019.

Summary of previous semesters and plan for the next:

In 2015A we received only **~60%** of the approved observations. The project was awarded 20 hours: 15 hours in Band 1 under the project GN-2015-Q-3 and 5 hours in Band 2 under project GN-2015A-Q35. We received **11.5 hours** for the observations of the galaxies **NGC3516** and **NGC5506** in both the J and K bands, 1.5hrs more than requested because they had difficulty in the acquisition of NGC5506. We received also 2 (0.2 hrs) of 10 requested exposures for NGC4388 and no data for NGC4939.

In 2015B we received **~50%** of the approved observations. We were awarded a total of 15hrs in project GN-2015B-Q-29: 2.5hs to observe NGC2110 in the J-band, 10 hours to observe J and K bands of Mrk9 and NGC788, and 2.5hrs to observe the K-band of NGC3081, but only observations in the J-band for **NGC2110** and in the J and K bands of **NGC788** were obtained. We did not receive any data for Mrk9 and NGC3081.

In 2016A we were awarded 15hrs to observe three galaxies in project GN-2016A-Q-6: NGC3227, NGC4235, J-band NGC4388 and NGC4939, but received only **59%** of the awarded time, comprising observations of **NGC3227** and **NGC4235**.

In 2016B we were awarded 15hrs to observe three galaxies in the project GN-2016B-Q-26: NGC1125, NGC2992 and NGC3081 but received no data, receiving instead the following remark regarding this project: "This program is in band 1 and has been accepted for rollover into semesters 17A and 17B if not completed in 16B." Thus we were expecting to observe these three galaxies in 2017A and/or 2017B.

In 2017A we were awarded 15hs to observe three galaxies in the project GN-2017A-Q-4: NGC3393, NGC 3786 and NGC5728. As pointed out above, these galaxies can be observed with NGS, but no observations were obtained.

In 2017B, we also did not receive any data (although we had a 2016B program in rollover), as NIFS was not available.

In 2018A, observations of 5 galaxies were in the queue (GN-2017A-Q-4, rollover and GN-2018A-Q-106), but we received no data.

For 2018B, we have had approved 17.5hs to observe 5 more galaxies (NGC1194, NGC3035, NGC4939, NGC4388, NGC1125) in proposal GN-2018B-Q-140. Between August 1st and September, we received the notification that data for the galaxy **NGC1125** was obtained.

If we receive during the semester the observations of the rest of the galaxies, we will need observations of 5 more galaxies to complete 75% of the project.

As it is not clear if the rollover status of our previous approved proposals is still active, we propose, for semester 2019A, observations of the same galaxies approved but not observed in GN-2017A-Q-4: NGC3393, NGC 3786 and NGC5728, plus the 2 galaxies approved and not observed in GN-2017B, which are rollover from GN-2016B-Q-26: NGC2992 and NGC3081.

Assessment of the data:

We have reduced all the data received so far: J and K-bands observations of NGC3516, NGC5506, NGC788, J-band observations of NGC2110, J and K-band observations of NGC3227and NGC4235.The reduction effort was led by Rogemar Riffel.

Calibrations:

The data has good quality, but we have had a few problems with calibrations when there are observations of the same target in two different nights. We have been solving these problems via calibrated long-slit cross dispersed spectra both from previous and new observations obtained by the student Luis Gabriel Hahn at IRTF (InfraRed Telescope Facility, NASA, Hawaii) and at the Blanco telescope instrument ARCoIRIS.

Data analysis:

(1) We have been using a Butterworth filter to reduce the noise in the data, and remove instrumental fingerprints.

(2) We have been using the program PROFIT (Rogemar Riffel) for the measurement of the emission lines via the fit of one or more Gaussians or Gauss-Hermite polynomials.

(3) We are using the program Starlight (Cid Fernandes 2004) adapted for observations in the near-IR by Rogério Riffel for the study of the stellar population, as well as black body components (to account for the contribution from the dusty torus) and a power-law continuum (to account for the AGN continuum).

(4) Stellar kinematics: We have obtained the stellar line-of-sight velocity distribution (LOSVD) of each galaxy by fitting the spectra within the range 2.26–2.40 μm (rest wavelengths), which includes the CO absorption band-heads from 2.29 to 2.40 μm using the library of near-IR stellar spectra of Winge, Riffel & Storchi- Bergmann (2009). The fitting of the spectra was performed using the penalized Pixel-Fitting pPXF method (Cappellari&Emsellem 2004), that finds the best fit to a galaxy spectrum by convolving template stellar spectra with a given LOSVD, under the assumption that this distribution is well represented by a Gauss-Hermite series.

(5) We are modeling the stellar and emission line kinematics. In the case of the gas kinematics, we fit rotation models that, when subtracted from the measured kinematics, allows the isolation of non-circular motions, where we investigate the signatures of feeding (via inflows) and feedback (via outflows).

Software development:

Dr. Rogério Riffel and his students have developed a tool, called "MEGACUBE", with an initial goal to fit the continuum via spectral synthesis over the whole data cube (using different stellar population bases, continua and varying fitting parameters) to produce maps of the star formation history, mean ages, mean metalicities in a uniform way for all the datacubes obtained in the LLP. These maps will be stored in the MEGACUBE together with the reduced data. A recent development is to include also in the MEGACUBE maps for the gas flux distribution and kinematics as well as the stellar kinematics.

Collaborations:

We are collaborating with the group of Dr. Richard Davies from the Max Planck Institute for Extraterrestrial Physics, in the analysis of some X-Shooter data for a similar sample of nearby AGN as well as of a control sample. The control sample is important mainly for the analysis of the stellar population, and he agreed to collaborate with us allowing us to use their control sample.

Conferences:

Some of the results shown below as well as those from previous targets from the BAT sample were presented by Thaisa Storchi-Bergmann in invited talks at: (1) the IAU General Assembly, August 2015, Meeting #29, #2286157, entitled "Active Galactic Nuclei in 3D: feeding and feedback processes"; (2) at the conference "The Interplay between local and global processes in galaxies", that took place in Cozumel, Mexico, in April 11-15, 2016; (3) at the European Weak of Astronomy and Astrophysics in Prague, in June 2017, entitled "Observational constraints on outflows from Active Galactic Nuclei"; **(4) at the meeting "Science and Evolution of the Gemini Observatory", in San Francisco, July 2018, entitled "Feeding and Feedback from Supermassive Black Holes from Gemini IFU Observations".**

Rogemar Riffel, Rogério Riffel and Thaisa Storchi Bergmann, presented results from this project at the conference "Are AGN Special?", in Durham, England, July 2018.

The PhD students Natacha Dametto and Luis Dahmer Hahn presented results of their work based on LLP2 observations in two scientific meetings: "International Workshop on Stellar Libraries in Campos do Jordão" in Feb. 2017 and Natacha Dametto further presented these results in the meeting "Nebulaton" (May 2017) and "Escola de Inverno do Observatório Valongo" (May 2017).

4. Sample results

Stellar kinematics:

In an effort led by Rogemar Riffel, we have measured and analyzed the stellar kinematics of the 16 galaxies listed in Table 1 (the 4 previously observed + 6 galaxies observed via the LLP of the main sample plus other 6 -- non-BAT -- galaxies from previous observations) via the program pPxf (Cappellari & Emsellem 2004), that finds the best fit to a spectrum by convolving template stellar spectra with a given LOSVD, under the assumption that this distribution is well represented by a Gauss-Hermite series. Results from these measurements as well as from the fit of a circular rotation model and its subtraction from the LOSVD is shown in Fig. 2 for the galaxy NGC788. A paper with the results for the 16 galaxies listed in Table 1 is now published: Riffel, R. A. et al. 2017, MNRAS, 470, 992.

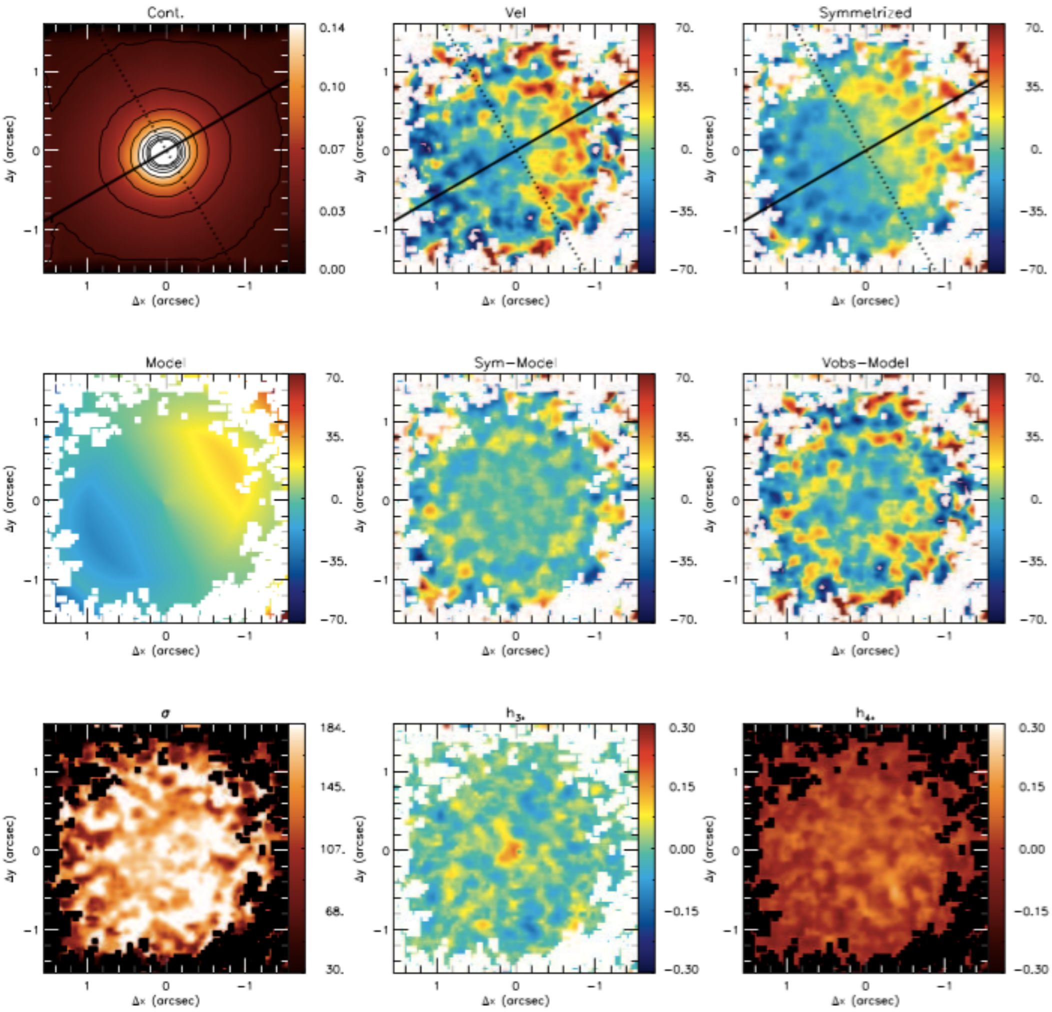

Figure 2. Stellar kinematics of the inner 3"x 3" of NGC 788: Top-left: K-band continuum image obtained by averaging the spectra, with the color bar shown in units of 10^{-17}erg cm^{-2} s^{-1}; top-center: stellar velocity field; top-right: symmetrized velocity field; middle-left: rotating disk model; middle-center: residual map for the symmetrized velocity field; middle-right: residual map for the observed velocity field; bottom-left: stellar velocity dispersion; bottom-center: h3 Gauss-Hermite moment and bottom-right: h4 Gauss-Hermite moment. White regions (and black regions in σ and h4 maps) are masked locations and correspond to regions where the signal-to-noise ratio of the spectra was not high enough to allow reliable fits. The continuous line identifies the orientation of the line of nodes and the dotted line marks the orientation of the minor axis of the galaxy. North is up and East to the left in all maps. The color bar for the velocity field model, residual maps and σ show the velocities in units of km s^{-1}and the systemic velocity of the galaxy was subtracted from the observed velocities.

Stellar Population

The stellar population is being analyzed by the PhD students Marlon Diniz under the supervision of Rogemar Riffel and by Luis Gabriel D. Hahn under the supervision of Rogério Riffel. While Marlon is focusing on the NIFS data only, Luis Gabriel is combining NIFS and GMOS data (when available for the same galaxies) to perform a panchromatic study of the stellar population. NIFS maps for the stellar population distribution as well as that of a Featureless Continuum and Black Body contribution attributed to a dusty torus are shown in Fig. 3 for NGC3516, and are part of the PhD Thesis of Marlon Diniz. A paper with the results of the stellar population for Mrk573 obtained using the same method is already published (Diniz, M. R. et al., 2017, MNRAS, 467, 3286).

An update of the results from the analysis of the data on the galaxy NGC1052, lead by Luis Gabriel D. Hahn follows. We have mapped the gas excitation and kinematics, and the stellar population properties in both the optical and in the J and K near-Infrared bands. Emission-line flux distributions reveal, besides a rotation component, two regions wit double-peaked profiles along the radio jet. The optical flux-ratios show extended LINER emission throughout the 5.0"x3.0" field of view. These regions are found to be compatible with inflows/outflows. Principal component analysis (PCA) reveal an unresolved broad line region centered at the nucleus, consistent with a low luminosity active galactic nucleus (LLAGN). This scenario is compatible with the X-ray source located in the same point. In the near infrared, the emission lines are much weaker, with only the [FeII] and H2 lines displaying extended emission. Also, for the first time in the literature, we combine optical and NIR datacubes and perform stellar population synthesis. By using the optical alone, we find only contribution from old stellar populations. When adding the NIR, on the other hand, we detect a featureless continuum at the nucleus, associated with the LLAGN and compatible with the PCA results.

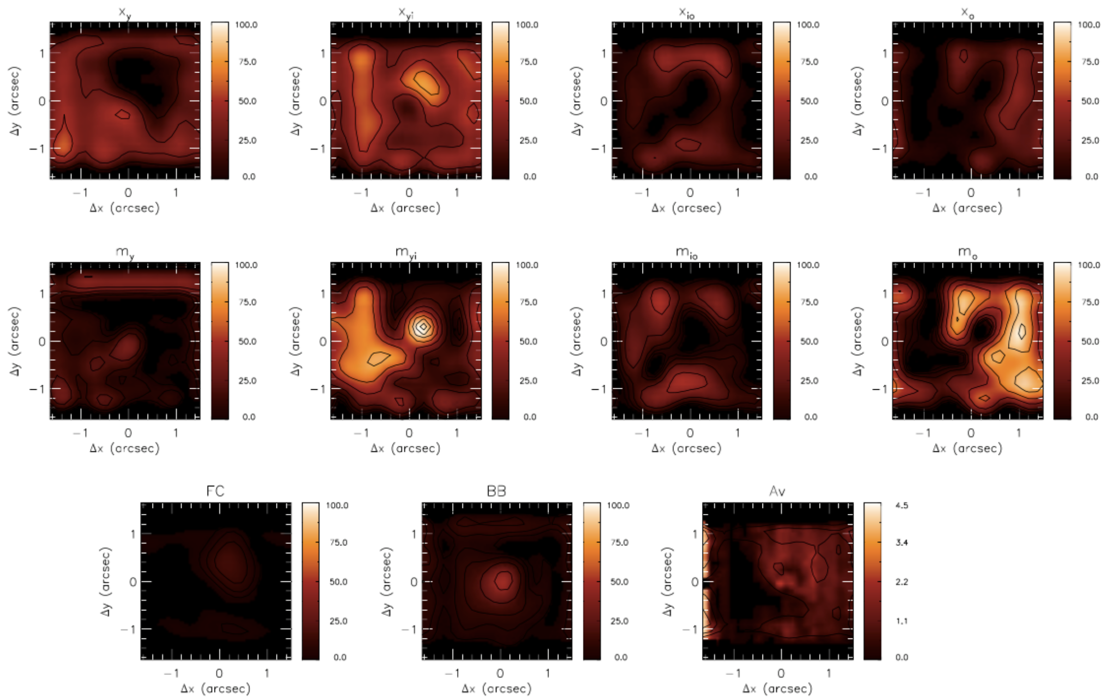

Fig. 3: NGC3516: Top row: Results of the spectral synthesis, where x_y, x_{yi}, x_{io} and x_o represent the percent contribution to the continuum at 2.2μm of stellar populations within the age bins (in yrs) 1E3-1E8, 1.01E8-7E8, 7.01E8-2E9, 2.01E9-15E9, respectively. In the second row we show the percent contribution of the each age bin in mass. The bottom row shows, from left to right, the percent contribution of the featureless continuum FC, the black body component (with temperature T~1000K to account for the torus contribution) and the reddening affecting the stellar population.

Emission line flux distributions, ratios, gas masses and kinematics:

We have obtained the gas flux distributions, excitation and kinematics in the J- and K-band emission lines for all galaxies observed, using the PROFIT routine to fit Gauss-Hermite polynomials to the emission lines. This is illustrated in Fig. 4 below for NGC 5506, and has already been obtained for all the galaxies observed in the LLP. On the basis of these measurements and assumptions regarding the gas density, we have also calculated the gas mass surface densities in units of $M_\odot$ per pc^2 for the ionized and hot molecular gas. We have also calculated the average gradients of these properties. This is illustrated for NGC 788 and Mrk 607 in Fig. 5 below. These results are from a submitted paper by the PhD student Astor Schonell, and part of his PhD Thesis.

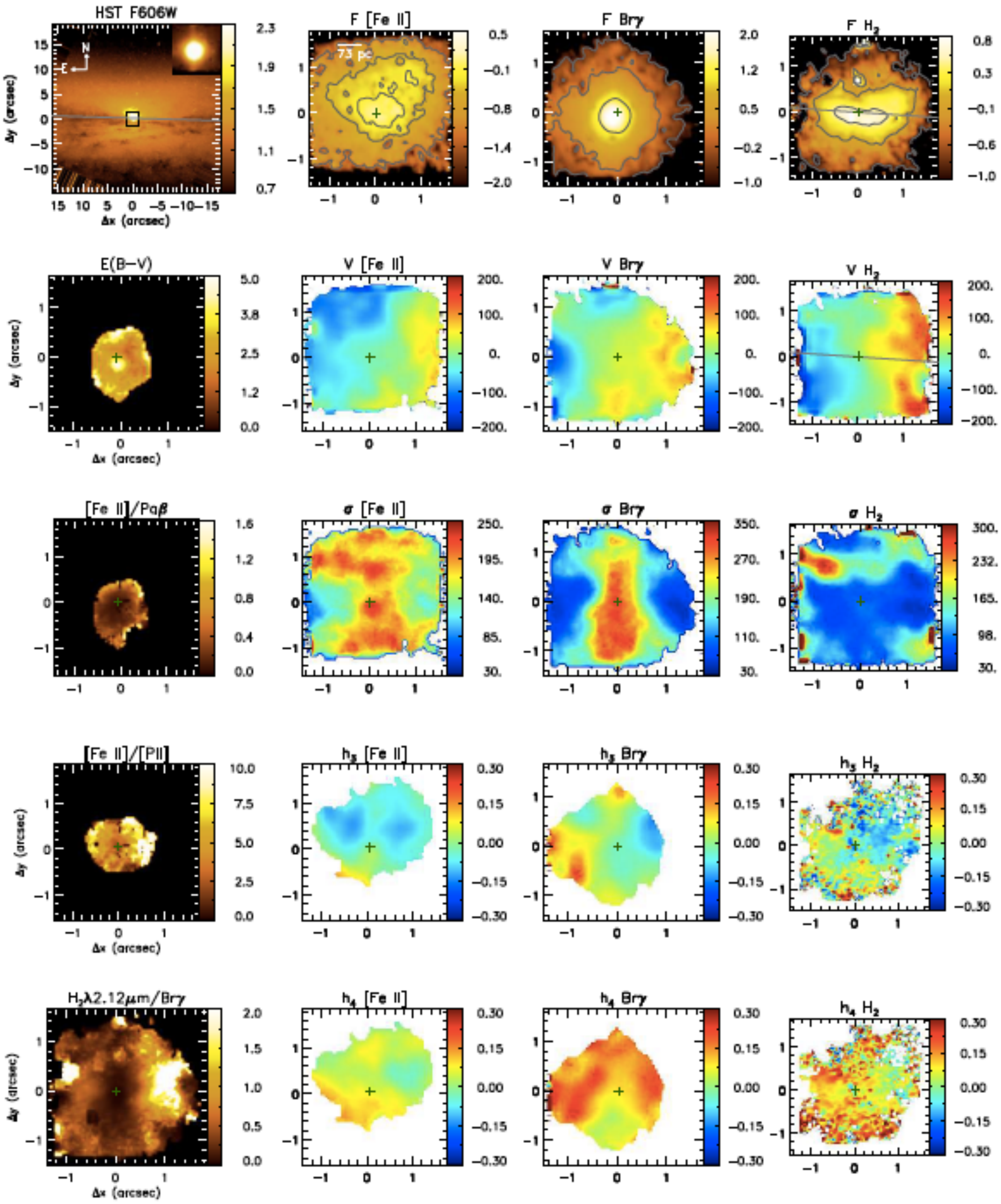

Figure 4: Top row: HST-WFPC2 continuum image of NGC5506 obtained through the filter F606W and flux distributions in the [FeII]1.257μm, Paβand H_2 2.122μm emission lines; following rows: emission-line ratios and gas kinematics. The flux distributions are shown in logarithmic units of 10^{-17} erg cm^{-2} s^{-1}. The LOSVD (Vel) and velocity dispersion (sigma) are shown in units of km s^{-1}. h3 and h4 are Gauss-Hermitte moments.

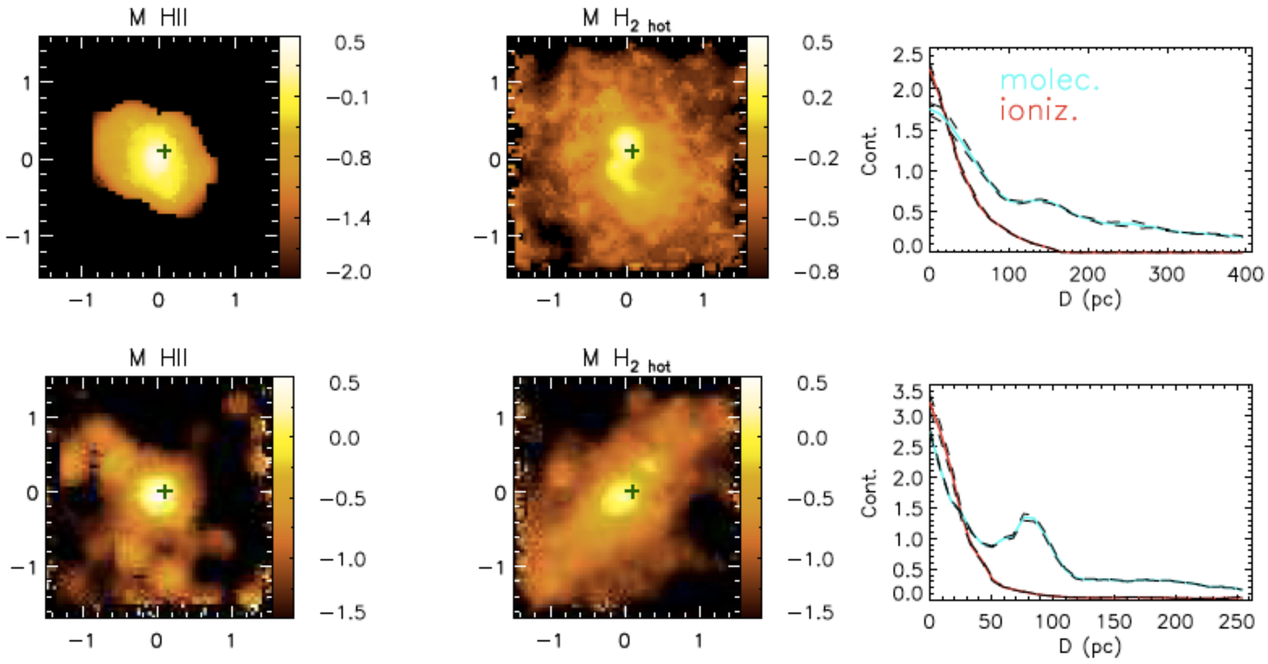

Fig. 5: Gas surface mass density distributions of NGC 788 (top) and Mrk 607 (bottom) for the ionized (left column) and hot molecular (central column) gas. Units are $10^4 M_\odot\ pc^{-2}$ for the ionized gas and $M_\odot\ pc^{-2}$ for the hot molecular gas. The third column shows the average radial profile of these two surface mass densities in the same units.

We have also calculated the total gas masses within the 3"x 3" FOV and average surface mass densities, which are listed in Table 1 bellow for all the galaxies analyzed so far, which are also part of the PhD Thesis of Astor Schönell

Table 1 - Column (1): identification of the galaxies (including 6 galaxies from the LLP plus data from previous NIFS observations); (2) area corresponding to the emission of molecular hydrogen (in pc^2);(3) area of ionized hydrogen (in pc^2); (4) mass of hot molecular gas (in solar masses);(5) mass of cold molecular gas (in solar masses); (6) mass of ionized gas (in solar masses); (7) average mass surface density of hot molecular gas (in solar masses per pc^2); (8) average mass surface density of cold molecular gas (in solar masses per pc^2); (9) average mass surface density of the ionized gas (in solar masses per pc^2).

Galaxies	A (H_2)	A (HII)	M $(H_2)_h$	M $(H_2)_c$	M (HII)	μ $(H_2)_h$	μ $(H_2)_c$	μ (HII)
MRK 1157	$2.8x10^5$	$1.8x10^5$	$2.3x10^3$	$1.6x10^9$	$5.4x10^6$	$8.2x10^{-3}$	5714	45
NGC 1068	$5.2x10^4$	$1.5x10^4$	29	$2x10^7$	$2.2x10^4$	$5.6x10^{-4}$	384	1.4
MRK 1066	$2.5x10^5$	$1.9x10^5$	$3.3x10^3$	$2.4x10^9$	$1.7x10^7$	$1.3x10^{-2}$	9600	89
NGC 2110	$1.1x10^5$	$7x10^4$	$1.4x10^3$	$9.9x10^8$	$1.7x10^6$	$1.3x10^{-2}$	9000	24
MRK 79	$9.8x10^5$	$7.8x10^5$	$3x10^3$	$2.2x10^9$	$7x10^6$	$3.1x10^{-3}$	2245	9
NGC4051	$1.3x10^4$	$1.4x10^4$	66	$4.7x10^7$	$1.4x10^5$	$5.3x10^{-3}$	3760	9.8
NGC4151	$2.4x10^4$	$1.9x10^4$	240	$1.7x10^8$	$2.4x10^6$	$1.8x10^{-2}$	7083	125
MRK766	$3x10^5$	$2.7x10^5$	$1.3x10^3$	$9.8x10^8$	$7.6x10^6$	$4.3x10^{-3}$	3266	29
NGC5548	$1.7x10^5$	$6.7x10^5$	$2.3x10^2$	$1.7x10^8$	$2.2x10^6$	$6.6x10^{-3}$	3473	7.2
NGC5929	$1.2x10^5$	$7x10^4$	471	$3.5x10^8$	$1.3x10^6$	$3.9x10^{-3}$	2966	18
NGC5506	$1.4x10^5$	$1.2x10^5$	$1.4x10^3$	$1x10^9$	$3.2x10^7$	$9.7x10^{-3}$	7951	244
NGC3516	$8x10^4$	$6x10^4$	517	$3.7x10^8$	$3x10^5$	$6.4x10^{-3}$	6168	5

NGC788	$6.2x10^5$	$5.5x10^5$	1012	$7.3x10^8$	$4.8x10^6$	$1.6x10^{-3}$	1319	8.8
NGC3227	$8.8x10^4$	$4.4x10^4$	1274	$9.2x10^8$	$1.7x10^6$	$1.4x10^{-2}$	20682	39
NGC5899	$1.9x10^5$	$8.7x10^4$	559	$4x10^8$	$4.2x10^5$	$2.9x10^{-3}$	4624	4.8
MRK607	$5.9x10^4$	$2.3x10^4$	182	$1.3x10^8$	$1.1x10^6$	$3x10^{-3}$	5710	48

5. Overall status

We are now in the seventh semester of the LLP (2018A), but we got no data during 2016B, 2017A and 2017B and only ~60% of the data for semesters 2015A, 2015B and 2016A.

As we have developed a lot of expertise in this study, in order to be able to conclude it, we have proposed NGS observations for 2018A and for the next semester non-AO observations, as the remaining galaxies are close and bright enough for us to still get valuable data in order to finalize the project.

We presently have 3 PhD students and 1 Post-doc working in the project. Dr. Marlon Diniz just finished his Thesis and is now a post-doc at UFSM. He is in charge of the analysis of the stellar population. Natacha Dametto is comparing stellar population synthesis results between the optical and near-infrared and investigating the best stellar population templates for the synthesis. Luis D. Hahn is working in the analysis of the calibration between the J and K bands, using cross-dispersed data from IRTF and Blanco, helping with the development of the MEGACUBE tasks and performing panchromatic spectral synthesis using combined data cubes GMOS-IFU + NIFS. In the present (2018A) semester, Marina Bianchin has started her the PhD at UFSM and is working with the gas kinematics in collaboration with Dr. Astor Schönell Jr. who finished his PhD in 2017B.

Reduction of data is complete, as well as the fits of the emission lines. Most "protocols" for data analysis and reduction are ready, including MEGACUBE.

6. Observing plan and data release

With our LLP we aim at completing NIFS (+ALTAIR when possible) observations of a distance-limited sample of 20 Active Galaxies: 4 already observed via previous proposals plus 16 to be observed in this LLP. As already discussed in the initial part of this report, we have LLP J and K-band data now for 7 galaxies so far: NGC788, NGC 2110, NGC 3227, NGC 3516, NGC 4235, NGC5506, NGC1125. We thus still need to observe 9 more galaxies in order to reach the goals of our project.

In the present semester (2018B) we hope to get observations of 2 more galaxies (NGC3035 e NGC1194) and the 2018A proposal is in rollover for 2019A to observe other 2 galaxies (NGC2992 e NGC3081). We then need 5 more galaxies to complete our sample of 16 galaxies. For 2019A we propose the observations of the 3 galaxies that can be done using the NGS mode: NGC3393, NGC4939 and NGC5728. The remaining 2, can only be observed in the LGS mode.

Table 2 shows our progress as well as the planned semesters for the forthcoming observations.

Galaxy	Activity	FWHM	Semester	Status
NGC788	Sy2	done	15B	Observed and reduced, 1 paper published and analysis on-going for additional papers
NGC1125	Sy2	0.56"	18B	Current semester, observed and being reduced
NGC1194	Sy1	Sy1	18B	Current semester
NGC2110	Sy2	done	15B	Observed, reduced, partial results in Diniz+2015.
NGC2992	Sy2	0.64"	18A (19A)	Not observed in 16B, neither 18A; rollover to 19A
NGC3035	Sy1	Sy1	18B	Current semester
NGC3081	Sy2	0.55"	18A (19A)	Not observed in 16B, 18A; rollover to 19A
NGC3227	Sy1.5	Sy1	16A	Observed and reduced, 1 paper published and analysis on-going for additional papers
NGC3393	Sy2	0.72"	19A	Not observed in 17A; being proposed for 19A
NGC3516	Sy1.5	done	15A	Observed, data reduced, 1 paper published and analysis on-going for additional papers
NGC3786	Sy1.8	0.70"	19A	Not observed in 17A neither 18A; being proposed for 19A
NGC4235	Sy1	0.47"	16A	Observed, reduced, 1 paper published and analysis on-going for additional papers
NGC4388	Sy2	partial	-	Only 800s in 15A -> need more time (LGS mode)
NGC4939	Sy2	0.68"	19A	Not observed in 16A, being proposed for 19A
NGC5506	Sy1.9	done	15A	Observed, data reduced, 1 paper published and analysis on-going for additional papers
NGC5728	Sy2	-	19A	Proposed for 19A.

7. Publications

Riffel et al. 2018, MNRAS, 474, 1373: Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: II -The sample and surface mass density profiles.

Riffel, R. A. et al., 2017, MNRAS, 470, 992: Gemini NIFS survey of feeding and feedback processes in nearby active galaxies - I. Stellar kinematics.

Diniz, M. R. et al., 2017: MNRAS, 469, 3286, Disentangling the near-infrared continuum spectral components of the inner 500 pc of Mrk 573: two-dimensional maps.

Previously submitted paper on the project (data from previous runs before the LLP2):

Schönell, A. J., Storchi-Bergmann, T., Riffel, R. A. &Riffel, R. 2017, MNRAS, 464, 1771: Feeding versus feedback in AGN from near-infrared integral-field spectroscopy XII: NGC5548

Diniz, Marlon R.; Riffel, Rogemar A.; Storchi-Bergmann, Thaisa; Winge, Claudia, 2015, MNRAS, 453, 1727: Feeding versus feedback in AGN from near-infrared IFU observations XI: NGC 2110

Riffel, Rogemar A., Storchi-Bergmann, T., Riffel, R. 2015, MNRAS, 451, 3587: Feeding versus feedback in active galactic nuclei from near-infrared integral field spectroscopy - X. NGC 5929

Storchi Bergmann, Thaisa, IAU General Assembly, Meeting #29, #2286157: Active Galactic Nuclei in 3D: feeding and feedback processes

Colina, Luis; Piqueras López, Javier; Arribas, Santiago; Riffel, Rogério; Riffel, Rogemar A.; Rodriguez-Ardila, Alberto; Pastoriza, Miriani; Storchi-Bergmann, Thaisa; Alonso-Herrero, Almudena; Sales, Dinalva 2015, A&A, 578, 48: Understanding the two-dimensional ionization structure in luminous infrared galaxies. A near-IR integral field spectroscopy perspective

Riffel, Rogemar A.; Storchi-Bergmann, Thaisa; Riffel, Rogério, 2015, IAU Symp. 309, 339: Near-IR Integral Field Spectroscopy of the central region of NGC 5929

Riffel, R.; Pastoriza, M. G.; Rodríguez-Ardila, A.; Dametto, N. Z.; Ruschel-Dutra, D.; Riffel, R. A.; Storchi-Bergmann, T.; Martins, L. P.; Mason, R.; Ho, L. C., 2015, ASPC, 497, 459: Models Constraints from Observations of Active Galaxies
Alf Drehmer, Daniel; Storchi-Bergmann, Thaisa; Ferrari, Fabricio; Cappellari, Michele; Riffel, Rogemar A. 2015, MNRAS, 450, 128: The benchmark black hole in NGC 4258: dynamical models from high-resolution two-dimensional stellar kinematics

8. PhD Theses

1. Diniz,M. R., 2017: "Estudo de populações estelares em galáxias ativas a partir de cubos de dados no infravermelho próximo", UFSM. Orientador*:* Rogemar A. Riffel

2. Schonell, A. J*.,* 2017: "Estudo da alimentação e Retro-alimentação de núcleos ativos de galáxias a partir de observações no infravermelho próximo", IF-UFRGS. Orientadora: Thaisa Storchi-Bergmann

3. Dametto, Natacha Zanon, September 24th, 2018: "Estudo das populações estelares em galáxias ativas no infravermelho próximo: o caso de NGC 4303", IF-UFRGS. Orientador: Rogério Riffel

Porto Alegre, September 30, 2018

Thaisa Storchi Bergmann

Thaisa Storchi Bergmann