BrazilianLarge and Long Program (BrLLP) LP002
Progress Report- September 2017

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

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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 ($-30° < \delta < 73°$). 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, since that semester we have had no observations, even though we were awarded the time. In summary, we received data only for 6 objects and are thus still missing observations of 10 objects.

In 2017A, we had an approved proposal (GN-2017A-Q-4) to observe NGC5728, NGC3786 and NGC3393 in the NGS mode, but did not receive any data. As this proposal has rollover status, **we expect that these galaxies are put in the queue for the next semester of 2018A.**

In 2017B, the on-going semester, we were expecting that the galaxies approved to be observed in 2016B (GN-2016B-Q-26) and that were not: NGC1125, NGC2992 and NGC3081, could be observed, because of the rollover status, but NIFS did not make it to the telescope. **We are thus submitting a proposal to observe the two galaxies that can also be observed with NGS: NGC3081 and NGC2992, as these galaxies are observable also in 2018A.**

If we receive the data for these 5 galaxies (NGC5728, NGC3786, NGC3393, NGC2992, NGC3081), all with rollover status, we will complete 15 targets, 75% of the sample. As our sample is small, it would be important to complete it, but if not possible, at least we would like to observe an additional 3 more galaxies to bring the total sample to 18 (90% of the sample).

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 the 6 galaxies observed with the LLP, e.g. via e-mail contact with the PI.

2. Answers to the comments and questions raised by the NTAC:

We answer below the questions raised in the evaluation of our last report by the NTAC:

- Question (1) The team lists 4 papers in various stages of preparation (2 submitted, 2 in preparation) but has not yet published any data from the program.

Answer: The two papers that were submitted are now published (see Section 3.1 below) and the 2 that were in preparation have been submitted. We are now working in another 5 papers, as also described in Section 3.1 below.

- Question (2) The report did not give an answer to the important question of "which of the science goals cannot be achieved without the extension and why not, and which science goals can still be achieved taking into account the completeness of the observations at the time the next report is due". To decide whether LP2 should continue beyond the rollover status time now scheduled for 2018A, the NTAC requested a detailed scientific justification/motivation for such extension, and not simply a statement that the program is currently not complete.

Answer: As we have pointed out above, of the 16 galaxies we expected to observe with the LLP, only 6 were observed, and we received data in only three semesters since the beginning of the LLP2 observations: 2015A, 2015B and 2016A. We received no data in 2016B and 2017A, and will not receive any also in 2017B, for reasons that were not under our control.

Our sample was carefully selected to cover a range of AGN luminosities that ensure that we will be able to investigate the relation between this luminosity and the properties we are measuring, such as gas masses, excitation, ionized region extents and geometry, kinematics, gas inflow and outflow rates, outflow powers, stellar population content and star formation rate.

Our LLP sample of 20 BAT-AGN (already chosen to be as small as possible) is representative of the complete BAT-AGN sample in terms of the AGN X-ray luminosities L_X, as shown in Fig. 1 below. But the 6 AGN that we have observed with the LLP, combined with 4 previously observed, comprise only 10 AGN. This is a very small number, subject to spurious variance, considering that we want to cover a distribution of AGN luminosities that is similar to that of the complete BAT-AGN sample. We show in Fig. 1 below the L_X distribution of the BAT-AGN (filled histogram) as compared with those of the proposed sample of 20 targets (hatched green histogram) and with the sample of the 10 AGN we have observed so far (hatched red histogram). It can be seen from this Figure that our incomplete sample, besides being too small, does not reproduce the BAT-AGN L_X distribution. We have computed the K-S probability that the two distributions are the same. The P value is listed within the panels and show that, although for the complete sample of 20 AGN there is 89% probability that the two distributions are the same, using only the observed sample, this probability decreases to 26%. It is not scientifically significant to use only 10 AGN to represent the whole BAT-AGN sample (covering the complete L_X range).

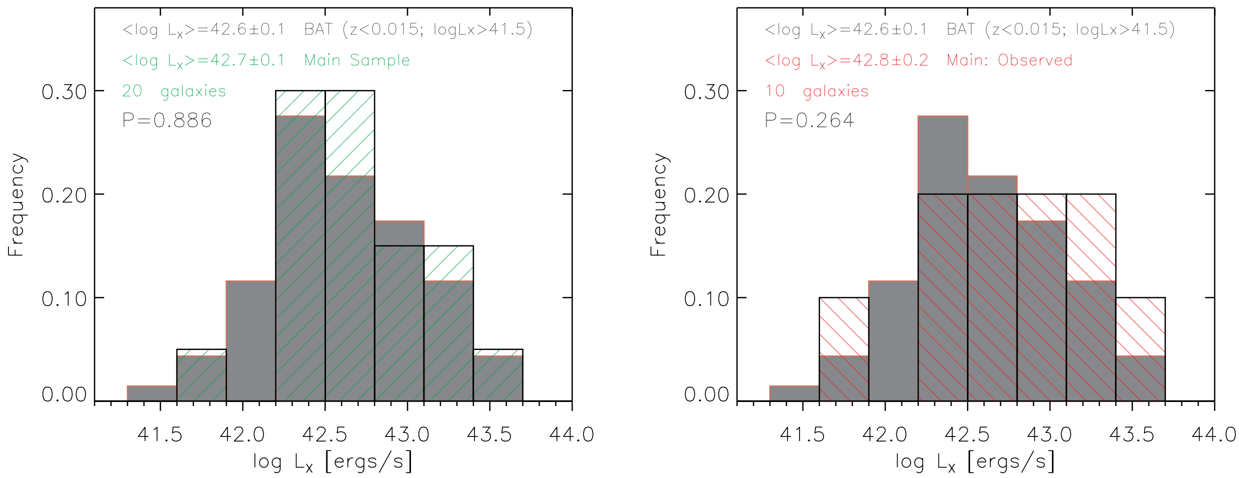

Figure 1: Distribution of the BAT-AGN sample in terms of the X-ray luminosity of the AGN (filled histogram) as compared with the distribution for the whole LLP sample of 20 AGN (green hatched histogram, left panel) and with the distribution of the 10 AGN (red hatched histogram, right panel) so far observed.

- *Concluding remarks: We look forward to future progress reports regarding data obtained, publications and data releases, and strongly urge the team again to provide a *scientific justification* in case they want to request for an extension of the program in the future. This justification should explain which of the science goals cannot be achieved without the extension and why not, and which science goals can still be achieved taking into account the completeness of the observations at the time of each report.*

Answer: Answers to the above remarks are given above. In particular, one of the main goals of the LLP is to relate the several properties we have been measuring to the luminosity of the AGN, and this goal cannot be reached with a sample that has only 10 objects, half of the total sample. We have been achieving partial goals, mapping the measured properties in each galaxy, and already finding a number of trends (e.g., via comparison of masses and kinematics of the ionized and molecular gas) when considering also a "complementary sample" comprised by other active galaxies (not from the BAT-AGN sample) as we have done in papers (1) and (3) listed below.

3. Progress of the work

3.1 – Updates from semester 2017A:

In the last semester we did not receive any NIFS data, as in the previous and present semester, mostly due to the failure of Altair. We have had only 6 galaxies observed in the LLP, in three semesters: 2015A, 2015B and 2016A.

But in 2017A we continued working with the data already in hand (the 6 galaxies observed via the LLP plus another 4 BAT-AGN from previous observations), having two papers published:

(1) Riffel et al. 2017, MNRAS 470, 992: *Gemini NIFS survey of feeding and feedback processes in nearby active galaxies - I. Stellar kinematics;*

(2) Diniz et al. 2017, MNRAS 469, 3286: *Disentangling the near-infrared continuum spectral*

components of the inner 500 pc of Mrk 573: two-dimensional maps.

Two other papers were submitted for publication:

(3) Riffel et al. 2017: *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: II -The sample and surface mass density profiles*;

(4) Schönell et al. 2017: *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: III - Gas distribution and excitation.*

The following papers are still "in progress":

(5) *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: IV - Resolved 2D stellar populations in the inner kiloparsec,* by Diniz, M. R. et al.; this paper applies the methodology developed in the paper number 2 above and contains many of the results of Diniz PhD Thesis.

(6) *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: V - 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.

(7) *Probing the AGN-SB connection in the Near-Infrared*, by Dametto et al.: this paper is will be the main paper of Dametto's Thesis, to be presented in second semester of 2018.

(8) *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.

(9) *2D Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: VI – 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.

In 2017A there has been an approved PhD Thesis, based on the LLP data, of Dr. Marlon Diniz, supervised by Dr. Rogemar A. Riffel, and for November 2017B we have scheduled the presentation of the PhD thesis of Astor Schönell Jr, supervised by Dr. Storchi-Bergmann, also based on the LLP and previous NIFS data.

Summary of previous semesters:

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.

For 2017B, we requested that the time awarded in 2016B to observe NGC 2992 and NGC 3081, that can be observed with NGS, but NIFS did not make it to the telescope because of the limited requested time to use it due to the unavailability of Altair.

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 the IAU General Assembly, August 2015, Meeting #29, #2286157, entitled "Active Galactic Nuclei in 3D: feeding and feedback processes" and at the conference "The Interplay between local and global processes in galaxies", that took place in Cozumel, Mexico, in April 11-15, 2016. 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. Recent 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.

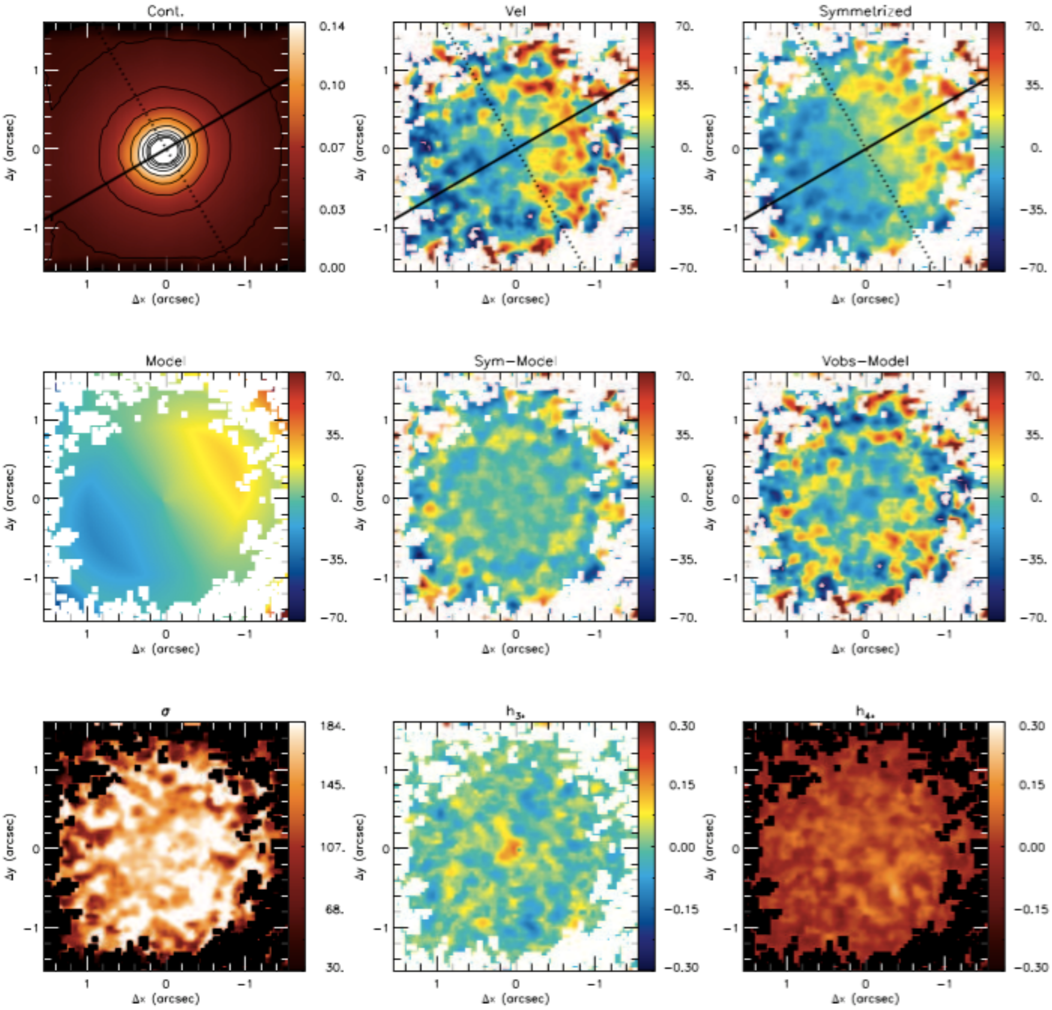

Figure 2. Stellar kinematics of the inner 3"x 3" of NGC 788: Top-left: K-band continuum image obtained by averaging the spectra, with the color bar shown in units of 10^{-17}erg cm^{-2} s^{-1}; top-center: stellar velocity field; top-right: symmetrized velocity field; middle-left: rotating disk model; 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.

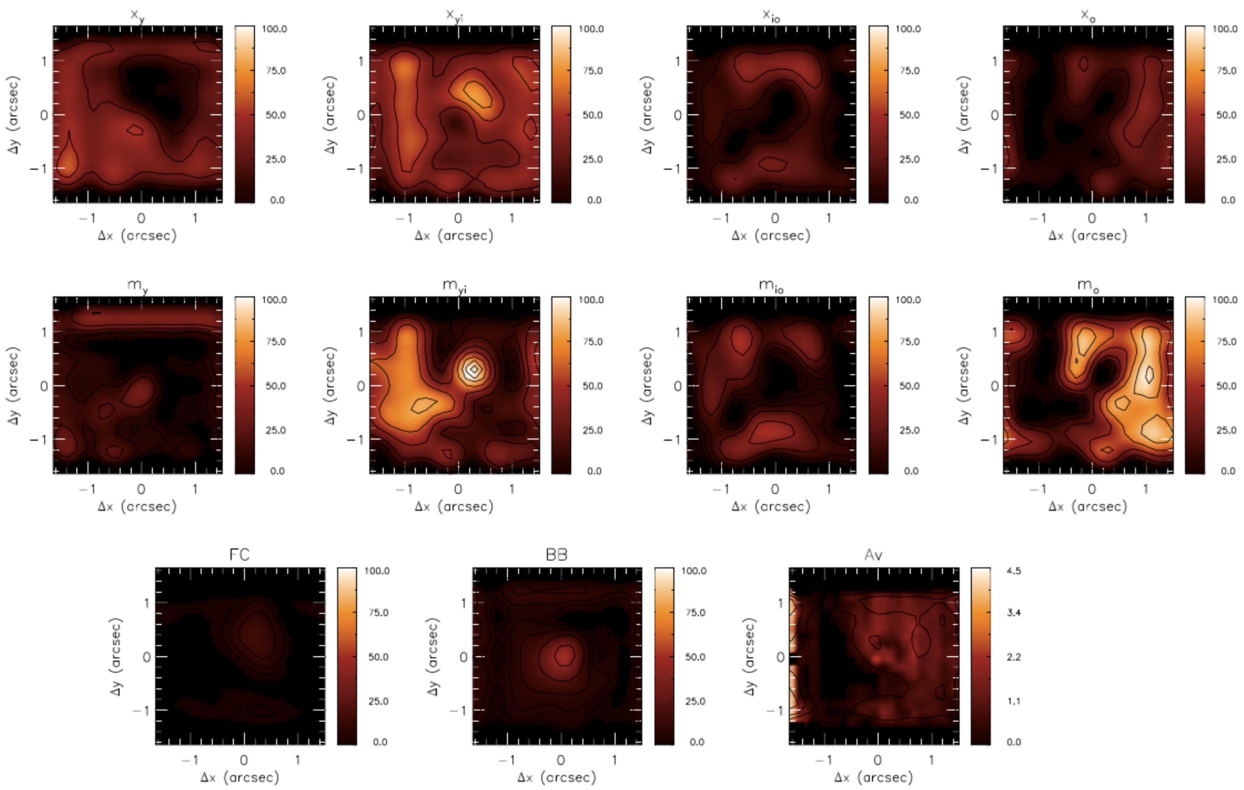

Fig. 3: NGC3516: Top row: Results of the spectral synthesis, where x_y, x_{yi}, x_{io} and x_o represent the percent contribution to the continuum at 2.2μm of stellar populations within the age bins (in yrs) 1E3-1E8, 1.01E8-7E8, 7.01E8-2E9, 2.01E9-15E9, respectively. In the second row we show the percent 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, as part of his PhD Thesis to be presented in November 2017.

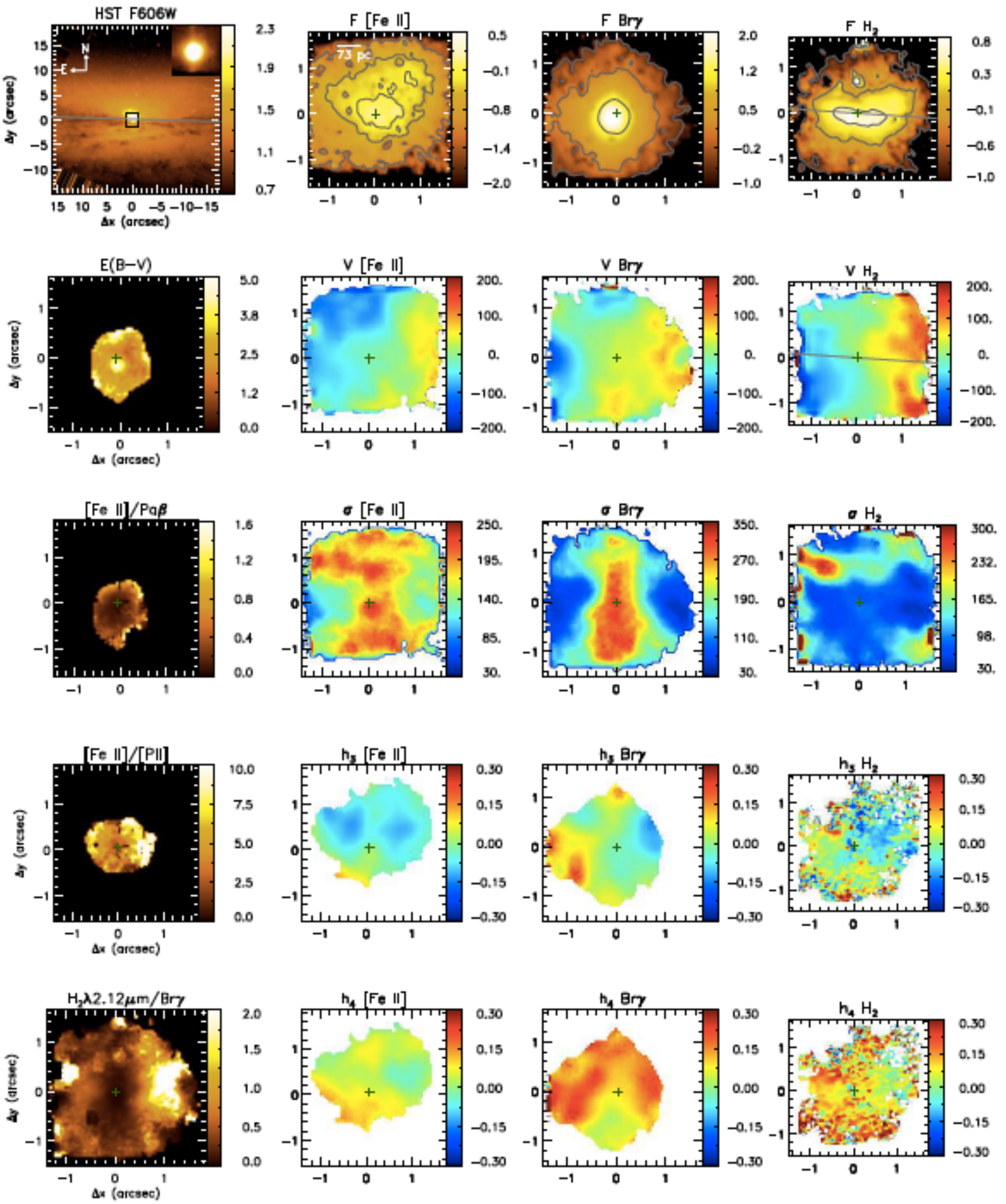

Figure 4: Top row: HST-WFPC2 continuum image of NGC5506 obtained through the filter F606W and flux distributions in the [FeII]1.257μm, Paβand H_2 2.122μm emission lines; following rows: emission-line ratios and gas kinematics. The flux distributions are shown in logarithmic units of 10^{-17} erg cm^{-2}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

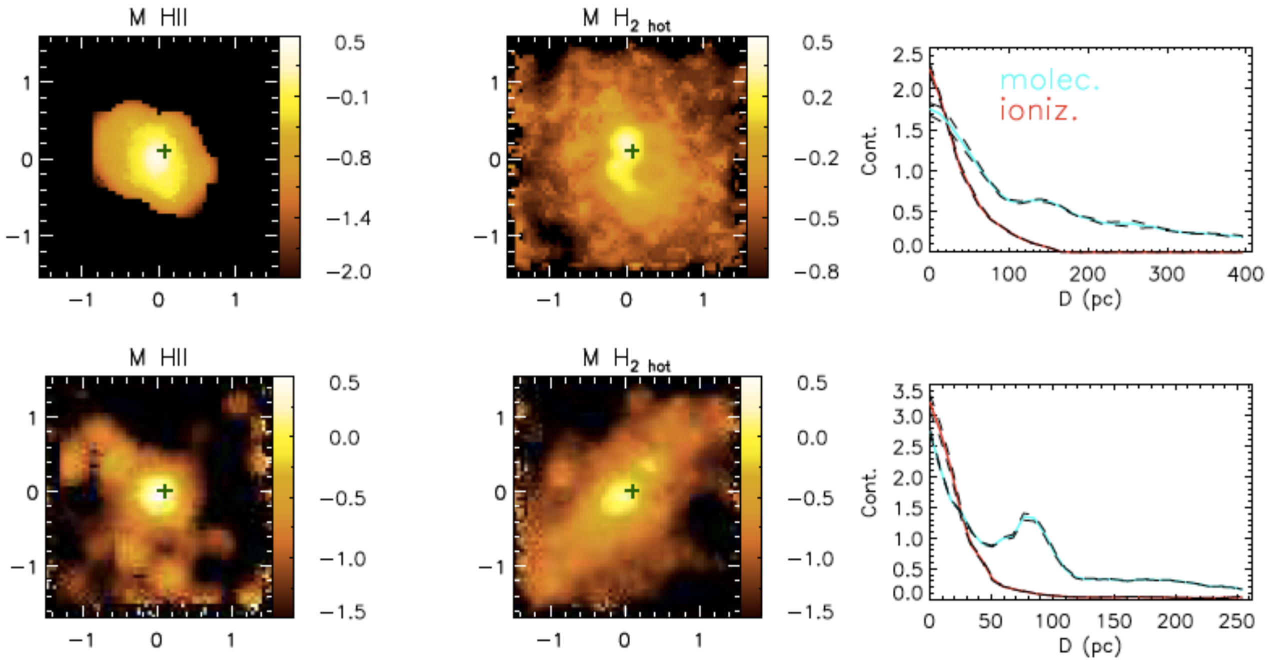

Fig. 5: Gas surface mass density distributions of NGC 788 (top) and Mrk 607 (bottom) for the ionized (left column) and hot molecular (central column) gas. Units are $10^4 M_\odot\ pc^{-2}$ for the ionized gas and $M_\odot\ pc^{-2}$ for the hot molecular gas. The third column shows the average radial 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 will also be 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	2.8×10^5	1.8×10^5	2.3×10^3	1.6×10^9	5.4×10^6	8.2×10^{-3}	5714	45
NGC 1068	5.2×10^4	1.5×10^4	29	2×10^7	2.2×10^4	5.6×10^{-4}	384	1.4
MRK 1066	2.5×10^5	1.9×10^5	3.3×10^3	2.4×10^9	1.7×10^7	1.3×10^{-2}	9600	89
NGC 2110	1.1×10^5	7×10^4	1.4×10^3	9.9×10^8	1.7×10^6	1.3×10^{-2}	9000	24
MRK 79	9.8×10^5	7.8×10^5	3×10^3	2.2×10^9	7×10^6	3.1×10^{-3}	2245	9
NGC4051	1.3×10^4	1.4×10^4	66	4.7×10^7	1.4×10^5	5.3×10^{-3}	3760	9.8
NGC4151	2.4×10^4	1.9×10^4	240	1.7×10^8	2.4×10^6	1.8×10^{-2}	7083	125
MRK766	3×10^5	2.7×10^5	1.3×10^3	9.8×10^8	7.6×10^6	4.3×10^{-3}	3266	29
NGC5548	1.7×10^5	6.7×10^5	2.3×10^2	1.7×10^8	2.2×10^6	6.6×10^{-3}	3473	7.2
NGC5929	1.2×10^5	7×10^4	471	3.5×10^8	1.3×10^6	3.9×10^{-3}	2966	18
NGC5506	1.4×10^5	1.2×10^5	1.4×10^3	1×10^9	3.2×10^7	9.7×10^{-3}	7951	244
NGC3516	8×10^4	6×10^4	517	3.7×10^8	3×10^5	6.4×10^{-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 sixth semester of the LLP (2017B), but we got no data during 2016B, 2017A and 2017B and only ~60% of the data for semesters 2015A, 2015B and 2016A.

The efficiency of data collection has been ~ 50%: we should have by now 15 galaxies observed, but we have only 6 observed so far, or actually 5 in both bands plus the J-band for NGC2110.

We have contacted Gemini about this, and learned that LLPs should have rollover status, and we thank the TAC for giving us this status, that we hope coudl warrant that we obtain the data we need for a successful conclusion of our project.

We have also received the information that it is important that the proposal is highly ranked as compared with GMOS proposals, for example. This is again due to the fact that NIFS+ATAIR is at the telescope usually only twice per semester, while GMOS is always in the telescope. A proposal similarly ranked (and even ranked lower) for GMOS has much higher chance of being executed than a proposal for NIFS+ALTAIR.

We presently have 3 PhD students and 1 Post-doc working in the project: (2) 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; (2) Astor Schönell is in charge of the analysis of the gas flux and mass distributions, excitation and kinematics, and will present his Thesis in November 2017; (3) Natacha Dametto is comparing stellar population synthesis results between the optical and near-infrared and investigating the best stellar population templates for the synthesis and (4) 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 2018A another student (Marina Bianchin) will be starting the PhD at UFSM and is supposed to work with the gas kinematics of the galaxies to be observed in 2018A and forthcoming semesters.

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 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 for only 6 galaxies so far: NGC788, NGC 2110, NGC 3227, NGC 3516, NGC 4235 and NGC5506. We thus still need to observe 10 more galaxies in order to reach the goals of our project.

For the coming semester (2018A) we hope to get observations of NGC3393, NGC3786 and NGC5728 with NGS, as rollover from semester 2017A. Although Altair will not have the Laser, all three galaxies can be observed with NGS after a change in SB conditions (from Any to SB=80%).

We are also requesting to observe in 2018A the galaxies approved for 2016B that were not observed and that can also be observed with NGS: NGC 2992 and NGC 3081.

With the observations of the above 5 galaxies, we will be covering 75% of the sample. We hope to obtain the observations of the remaining 5 additional galaxies in 2018B and 2019A.

Our effort with the MEGACUBE has the goal of storing the reduced data, together with the measurements of flux distributions and kinematic maps in each emission line, as well as the results of the spectral synthesis as extensions of the same cube. In the case of the spectral synthesis we plan to save maps of the percent contribution of each stellar population template, featureless continuum and black body (torus) contribution, as well as the reddening map. The MEGACUBE will then be made available in a data release by the end of our analysis of the data, that we estimate to happen during 2018-2019.

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	
NGC1194	Sy1	Sy1	18B	
NGC2110	Sy2	done	15B	Observed, reduced, partial results in Diniz+2015.
NGC2992	Sy2	0.64"	18A	Not observed in 16B-> proposing for 2018A
NGC3035	Sy1	Sy1	18B	Not observed in 16B-> rollover 2018B
NGC3081	Sy2	0.55"	18A	Not observed in 16B-> proposing for 2018A
NGC3227	Sy1.5	Sy1	16A	Observed and reduced, 1 paper published and analysis on-going for additional papers
NGC3393	Sy2	0.72"	18A	Not observed in 2017A -> rollover 2018A
NGC3516	Sy1.5	done	15A	Observed, data reduced, 1 paper published and analysis on-going for additional papers
NGC3786	Sy1.8	0.70"	18A	Not observed in 17A -> rollover for 2018A
NGC4235	Sy1	0.47"	16A	Observed, reduced, 1 paper published and analysis on-going for additional papers
NGC4388	Sy2	partial	19A	Only 800s in 15A -> need more time in 2019A
NGC4939	Sy1	0.68"	19A	Not observed in 16A -> rollover for 2019A
NGC5506	Sy1.9	done	15A	Observed, data reduced, 1 paper published and analysis on-going for additional papers
NGC5728	Sy2	-	18A	Not observed -> rollover 2018A

7. Publications

During the years 2015, 2016 and beginning of 2017, we have finalized and published the following papers using data from the galaxies of the BAT-AGN sample- the first 4 contain data from the LLP while the others are from the same project but based on data that have been obtained in previous runs:

Diniz, M. R., 2017: Estudo de populações estelares em galáxias ativas a partir de cubos de dados no infravermelho próximo, PhD Thesis, UFSM, Brazil.

Riffel, R. A. et al., 2017a, 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.

Riffel R. A. et al., 2017b: *Gemini NIFS survey of feeding and feedback processes in nearby active galaxies - II. The sample and surface mass density profiles*, MNRAS, submitted.

Schonell, A. J. et al., 2017: *Gemini NIFS survey of feeding and feedback processes in nearby active galaxies: III - Gas distribution and excitation,* MNRAS, submitted.

Schönell et al. 2017: *Gemini NIFS survey of feeding and feedback processes in nearby Active Galaxies: III - Gas distribution and excitation,* MNRAS, submitted.

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

PhD exam and Thesis: The student Astor Schönell presented his PhD exam in 2015B, where he collected relevant measurements for all the galaxies of the BAT sample such as: gas masses and surface mass densities – ionized and molecular, mass outflow and inflow rates, geometry, extent, velocities and power of the outflows. He will continue to collect these measurements to present a joint analysis and investigate correlations among these properties and between these properties and the power of the active nucleus. His Thesis will be presented in 2017B.

Marlon R. Diniz presented his PhD thesis in August 2017. He will continue working on the project as a Post-doc at UFSM, being responsible of the analysis of the stellar population studies.

Porto Alegre, Outubro de 2017

Thaisa Storchi Bergmann