What I would like to do:
Unveiling the black hole mass - host galaxy connection in obscured accreting supermassive black hole

What I will tell you today:
NIR BASS - technical report (no exciting science yet, sorry)
General goal: build a complete and unbiased sample of AGN, thus particular effort on obscured AGN.

Also, try to target lower-L AGN than previous BASS NIR data, by using large telescope (VLT, Magellan).

Why NIR?

- ~10 times less sensitive to reddening than the optical.
- Mbh from Ca II triplet and/or CO H- K- band heads and/or.
- hidden broad line region → can complement/help the optical information (for instance disentangle between real 1.9 or 2 with outflows and understanding systematics).
- several coronal lines.
- (more distant future: benchmark for JWST AGN studies).
NIR BASS DATA

- Palomar/Triplespec
  ★ 1 night
- VLT/Xshooter (PI Benny, ~100 obs)
- Magellan/FIRE
  ★ 2 nights (PI Ezequiel, 8+14 obs)

FIRE data reduction completed, even though molecfit need to be implemented

- Coming this semester, directly involved as observer:
  ★ 1 night 9 March (PI Federica, ~15 exp)
  ★ 1.5 nights 14-15 April (PI Mislav, ~20-25 exp)
1. **ppxf**: measure stellar velocity dispersion in the Ca T, **CO H-**/K- band heads. CO H- is the most promising, highest S/N most of the times

- up to now, acceptable CO H fit for 8/22
- TBDone: better fit CO H changing the masking region
- TBDone: run ppxf on CaT
- TBDone: run ppxf on CO K
2. pyspeckit (v 0.1.20, python 2.7.15): Emission line fitting. The code (from Isabella Lamperti) divides the spectrum in 7 regions (e.g. P14, Pzeta, Pdelta, Pgamma, Pbeta, SiX, Palpha, Brgamma) The first thing is constrain the NLR, thus the 1st region to fit is the one containing the SIII 9531 Å
Major updates (at the moment only Pa_\text{zeta} region of the spectrum):

1. tie the sigma of the narrow gaussians in velocity space rather than in wavelength space -> more physical

\[ \sigma_{\text{el},1}^N = \sigma_{N}^{\text{SIII}b} \times \frac{\lambda_{\text{el},1}^N}{\lambda_{\text{SIII}b}} \]

2. tie the central wavelength of the narrow component to have the expected ratio (restframe) wrt the SIII 9531 rather than a linear offset in velocity -> advantage of neglecting errors on redshift (if any)!

\[ \lambda_{\text{el},1,\text{FIT}}^N = \lambda_{N}^{\text{SIII}b,\text{FIT}} \times \frac{\lambda_{\text{el},1}^N}{9531.0\text{Å}} \]

```python
for k in range(len(NIR_emis)):
    offset =NIR_emis[k][0]/ NIR_emis[1][0] #NIR_emis[k][0]- NIR_emis[1][0]
    if k==1: # Fix the width of the [SIII]a line
        if flag[7]==F and flag[6]==F: # Fix the amplitude of the [SIII] line, if there is not the Pa_eps
            tied=tied+['p[3]', '','']
        else:
            tied=tied+['','',''] # [SIII]b line is free
    else:
        tied=tied+['','p[4]*{0}'.format(offset),'(p[5]/p[4])*(p[4]*{0})'.format(offset)]
```
Major updates (at the moment only Pa\_zeta region of the spectrum):

3. for the broad lines in the region (Pa10, Pazeta, Paeps), the central wav of the narrow component is tied with the wav ratio of SIII while the broad component is tied wrt the expected wavelength ratio of the Pazeta

\[ \lambda_{B}^{el,1,FIT} = \lambda_{B}^{Pa\zeta,FIT} \times \frac{\lambda_{el,1}}{\lambda_{Pa\zeta}} \]

4. the sigma of the broad component is tied in wav to the Pazeta rather than in velocity (no update wrt Isabella's version)

\[ \sigma_{B}^{el,1,FIT} [\AA] = \sigma_{B}^{Pa\zeta,FIT} [\AA] \]
Major updates (only Pa_zeta region of the spectrum):
5. fix the maximum range of velocity shift in the emission lines in velocity space rather than in wav -> up to ±500 km/s for narrow and up to ±1000 km/s for broad lines

```python
# maximal offset for the central wavelength
shift_v_n = 500 # km/s
shift_v_b = 1000 # km/s
shift_A_n = shift_v_n/c*wave_narr # Conversion in Angstrom

if m < (nbr_lines-nbr_broad*2)*3:
    minp.append(element - shift_A_n) # changed from 8 A to 500 km/s
    maxp.append(element + shift_A_n)
    lmin.append(True)
    lmax.append(True)
else:
    if p % 2 == 0:
        minp.append(element - shift_A_n)
        maxp.append(element + shift_A_n)
        lmin.append(True)
        lmax.append(True)
else:
    # Broad component
    shift_A_b=shift_v_b/c*guesses[m]
    # print 'm=',m,' guess', guesses[m],' shift_A_b', shift_A_b
    minp.append(element - shift_A_b) # changed from 30 A to 1000 km/s
    maxp.append(element + shift_A_b)
    lmin.append(True)
    lmax.append(True)
```
Comparison with DR1 in the Pazeta region

Comparative plots showing FWHM values for SIII and Pa10b between my code and ISA code.
PART I - data
✴ improve the telluric correction of FIRE with molecfit
✴ reduce the Triplespec data
✴ get more data.. going to observe a couple of FIRE runs

PART II - pPXF
✦ (wait and) include the NIR high resolution stellar template

PART III - pyspeckit
❖ implement the same the fitting criteria/constraints for the other emission line regions
❖ fit all the emission lines in BASS NIR spectra! The sample is at least doubled wrt BASS NIR DR1

What you need to do:
✓ Join the slack channel #nir_obscured_bhmass
✓ Give me suggestions! :)
✓ Want to talk about proposals?