SEARCH FOR VERY EXTENDED IONIZED GAS IN SEYFERT GALAXIES: MRK 938

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MOTIVATION

Presence of warm ionized gas in the outskirts (few kpc) of galaxies: confirmed by means of narrow band imaging.
The importance of very extended gaseous emission is outstanding:

Origen of the gas: outflows driven by the AGN / Ram pressure

Chemical enrichment of the intergalactic medium (AGN feedback; Schawinski et al 2007)

Consumption of gas reservoir to fuel star formation, quenching it (Springel et al 2005; Croton et al 2006).

➡ Galaxy evolution modified

➡ Constraints on the star formation history of the galaxies.

➡ SEARCH OF VERY EXTENDED IONIZED GAS AROUND NEARBY SEYFERT GALAXIES.

Detection of gas filaments up to distances of 35 kpc has been reported only in the galaxy NGC4388 (Yoshida et al 2002)

DATA

OSIRIS/GTC (Cepa et al 2010) + TF red in scanning mode:
Deep imaging centered on the Hα+[NII] emission plus the adjacent continuum.

Sample: 7 Seyfert 2 galaxies (Mrk938, Mrk348,Mrk573,Mrk1066,Mrk1157,NGC7465, NGC7675)
Observations: TF scan with FWHM 20Å and 10Å step (continuum, Hα, Hα+10Å, H+20Å continuum, texp=600s)
Date: Semester 09B

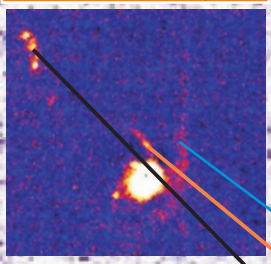
Mrk938

Relatively luminous (M_v=-21.6) at a distance of 85.2Mpc.
Nuclear spectrum between starburst-dominated and Seyfert 2.
Merger (as evidenced by the presence of tidal tails; Schweizer & Seitzer 2007; Mulchaey et al. 1996; Mazzarella & Boroson 1993).

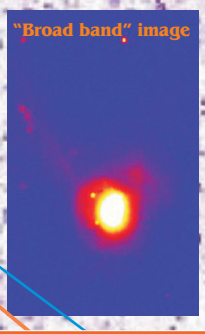
DATA REDUCTION

Problems: Dark current (noise!!!)+ dome flats (bad correction)
Three simple steps:
1. Subtract the continuum from the Hα image: morphology + detection of emission regions
2. Sum of five images: detection of emission regions
3. Flux measurement of detected emission regions in each image of the scan

Mrk938: Hα image

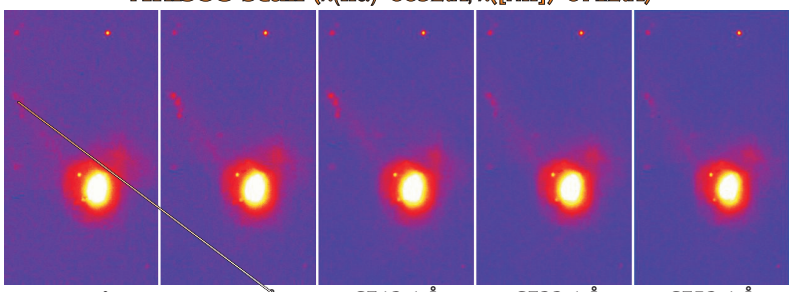


"Broad band" image



Detection limit: (1σ) = 2. 10^{-18}erg/s/cm^2/Å/arcsec^2
(Yoshida et al 2004, Subaru NF 1200s 3.10^{-18}erg/s/cm^2/Å/arcsec^2)

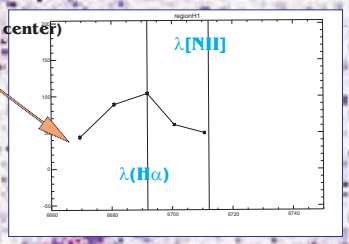
Mrk938 scan (λ(Hα)=6692.Å, λ([NII])=6712.Å)

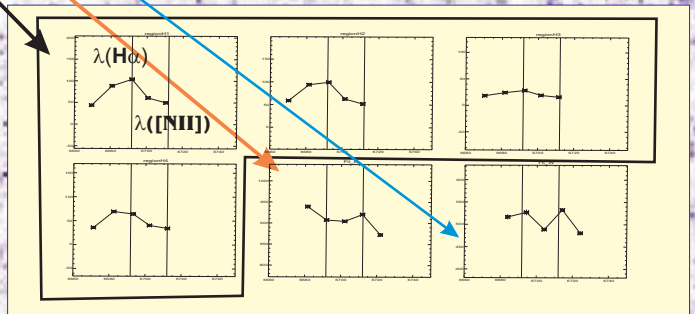


Flux measurement for each region in each scan image (Gaia+SExtractor)

Wavelength for each extracted region:
D=sqrt((2.*(xc-x))^2+(2.*(yc-y))^2)*0.127/60.
λ=λ_t*(1.-7.9520e-4*D^2)

SEDs for all extracted regions





Morphology

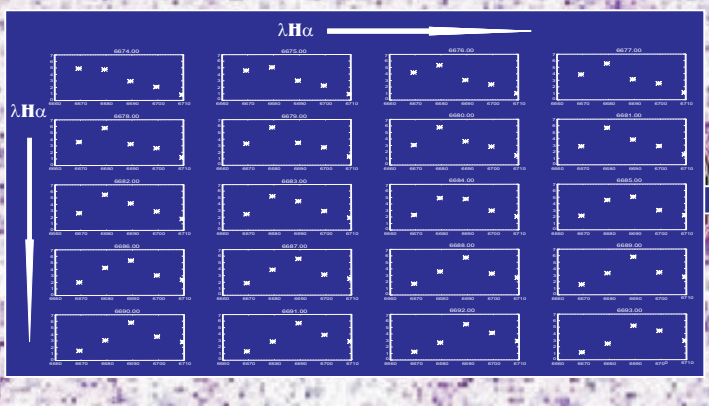
In continuum, complex morphology:
central part with spiral structure
tidal debris at levels of surface brightness faint
(Schweizer & Seitzer2007)

Hα morphology:
HII regions so far (35kpc from center)
Two "filaments" (diffuse emission)

Hα FLUX

To determine Hα flux:
Simple case: Total emission line flux in filter L
(+ continuum contribution)
Filter C: continuum (+ line contamination):

F_{ON}(Hα)=FHα + Fcont
F_{ON}(cont)=Fcont + Tcont(Hα)*FHα
where:
T= {1. + [2 (λ - λ_c) / δλ]^2} $^{-1}$
In our case, a scan of five bands permits to obtain low resolution spectroscopy
➡ Flux + kinematics



VELOCITY ESTIMATIONS

Simulations: typical spectrum of an HII region:
Convolution with TF scanning
Comparison with data results

➡ λHα emission in the regions

➡ Velocity

References

Cepa et al 2010, in preparation
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Mazzarella & Boroson 1993, ApJS, 85, 27
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