Polarimetric view of the changing type Seyfert galaxy ESO 362-G018

B. Agís-González, S. Bagnulo, D. Hutsemékers, B. Montesinos, G. Miniutti, M. Sanfrutos

Abstract

ESO362-G018 is an active galactic nucleus (AGN) which is classified as a Seyfert 1.5 galaxy e.g. by Bennert et al. (2006), (black data set on figure 1). However, Parisi et. al (2009) found an optical spectrum of this source which was taken during the 6dF Galaxy Survey, but it does not show the broad Balmer lines required to classify it as Seyfert 1 galaxy (red data set on figure 1).

On the other hand, the results obtained by Agís-González et al. (2014) in a X-ray analysis of this same source reveal that the inclination of ESO362-G018 $i = 53^\circ \pm 5^\circ$ is consistent with the picture of an AGN looked through the upper layers of a clumpy, dusty torus. Thus, according to the Unification Models of AGN and the clumpy nature of the torus, our interpretation of the different spectra is the following one. On 30th of January of 2003 (when the spectrum belonging to the 6dF survey was obtained), our line of sight intercepted a (or several aligned) torus clump(s) with much greater column density than its environment. Accordingly, the nucleus and the broad line region (BLR) would be obscured. This allowed only the narrow emission lines to emerge from the narrow line region (NRL). Otherwise, on 18th of September of 2004 (when the spectrum by Bennert et al. 2006 was obtained) there is no clump to intercept and the BLR is not obscured so that the broad Balmer emission lines could be detected.

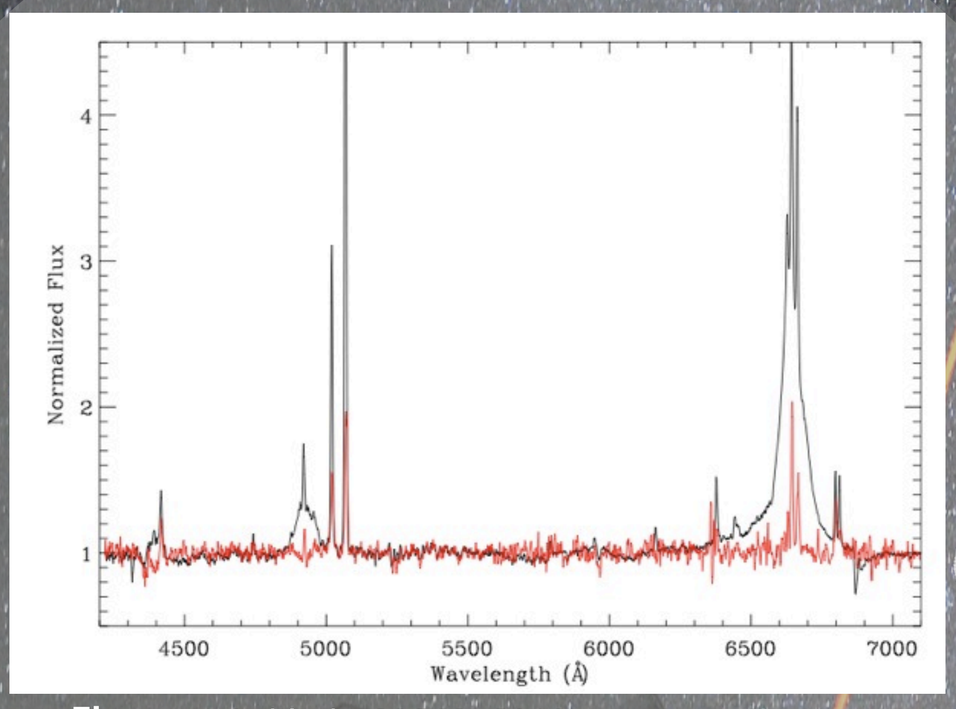
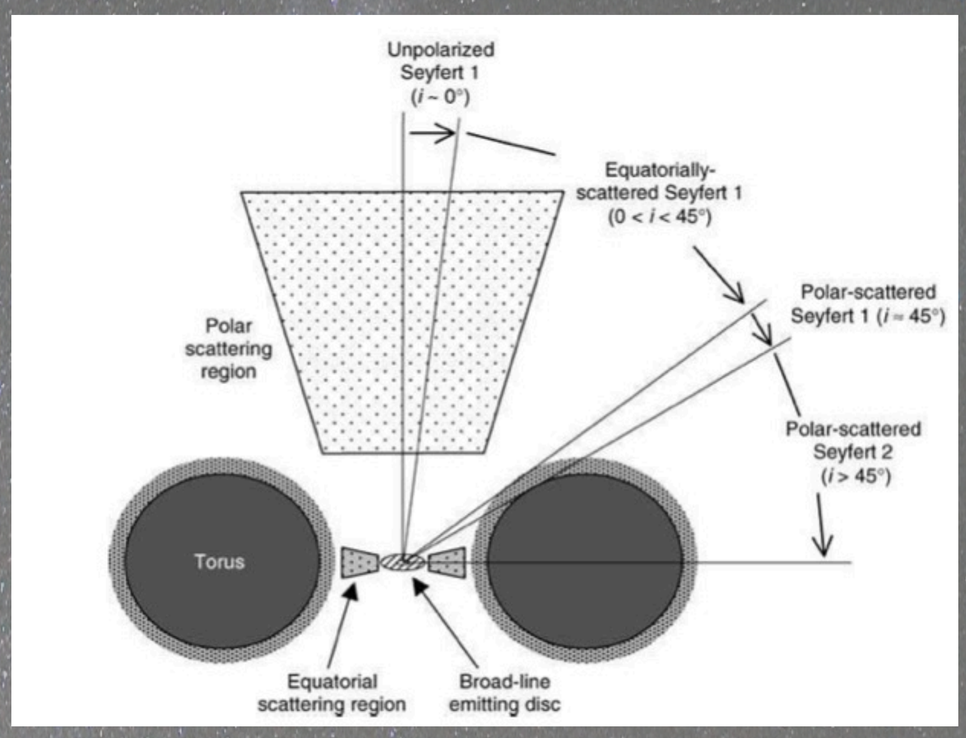


Figure 1: In black ESO362-G018 spectrum consistent with a Sy 1.5 type. In red another spectrum of the same source showing Sy 2 appearance. Both spectra are normalized to continuum .

HYPOTHESIS TESTING

Smith et al. (2002), Smith et al. (2004) and Smith et al. (2005) suggest a polarimetric classification of Seyfert galaxies consistent with the unification scheme. In this sequence the broad Balmer lines are emitted by a rotating disk and are scattered in two main regions: the equatorial scattering region, co-planar with the accretion disk and within the circumnuclear torus of dusty molecular gas, and the polar-scattering region, outside the torus. Using this scattering model, Smith et al. (2002) showed that the tilt angle between the symmetry axis of the AGN and the line-of-sight cannot, by itself, govern which component dominates the observed polarization. Instead, they propose a more refined classification of Seyfert galaxies based on the polarization properties and still consistent with the unification model represented in **Figure 2**:



The `partially' polar-scattered Seyfert 1 galaxies would represent a transition between traditional Seyfert type 1 and 2. Most Seyfert 1 are classified as equatorial-scattered, while Seyfert 2 are polar-scattered. Partially polar-scattered Seyfert 1 are objects in which the line-of-sight passes through the upper layers of the torus. Hence, the equatorial scattered light is attenuated allowing the polar scattering to dominate the polarization spectrum.

POLARIMETRY: A POWERFUL TOOL

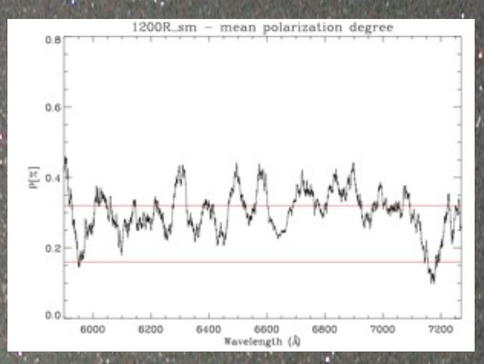
In this context, all signs are that we should observe ESO362-G018 in polarized light. Polarimetry does not only measure the amount of light per unit of time or wavelength, but also how electric field oscillates. Electric field oscillations are perturbed by any mechanism or element that breaks the symmetry in the radiative source allowing us to reconstruct those unresolved structures. Thus polarimetry can afford information on the geometry structures that are below the resolution limit of the telescope (Bagnulo et. al 2009).

Polarimetric observations of ESO362-G018 were granted in a ESO DDT porposal.

FORS2@VLT : IPOL -POLARIZED IMAGING- AND PMOS -SPECTROPOLARIMTRY- → FIRST RESULTS

- Both IPOL and PMOS results provide a polarization position angle PPA≈ $75^\circ \pm 10^\circ$ roughly perpendicular to the symmetry axis of the AGN. Then ESO362-G018 can be classified as a → POLAR-SCATTERED Seyfert 1

- Polarization degree, p, is also in agreement for R and V filters in two observing modes. On the left it is shown the very preliminary results for p in R filter for PMOS. Two red lines delimited the values obtained with IPOL. Thus, p is low and constant. Maybe it can be due to ISM polarization or noise. For confirming that, we are checking the field stars for estimating ISM polarization (very delicate process) and some unpolarized standard stars.
  On the right the reader can be found an example of an IPOL exposure, very ilustrative if you have never seen polarimetric images.
- These are our preliminary results and have to complete the analysis with process described above to give a reliable polarimetric view of this changing state Seyfert galaxy.



REFERENCES: [1] AgÍs-GonzÁlez B. et al. 2014, MNRAS, 443, 2862, [2] Bagnulo S. et al. 2009, PASP, 121, 993, [3] Bennert et al. 2006, A&A, 459, 55, [4] Parisi et. al 2009, A&A, 507, 1345, [5] Smith et al. 2002, MNRAS, 335, 773, [6] Smith et al. 2004, MNRAS, 350,140, [7] Smith et al. 2005, 359, 846.