

Linking the central engine to the jet properties in radio loud AGN

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Abstract. We explore the connection between the black hole mass and its relativistic jet for a sample of radio-loud AGN ($z < 1$), in which the relativistic jet parameters are well estimated by means of long term monitoring with the 14m Metsähovi millimeter wave telescope and the Very Long Base-line Array (VLBA). NIR host galaxy images taken with the NOTCam on the Nordic Optical Telescope (NOT) and retrieved from the 2MASS all-sky survey allowed us to perform a detailed surface brightness decomposition of the host galaxies in our sample and to estimate reliable black hole masses via their bulge luminosities. We present early results on the correlations between black hole mass and the relativistic jet parameters. Our preliminary results suggest that the more massive the black hole is, the faster and the more luminous jet it produces.

Keywords. galaxies: active, galaxies: jet

1. Introduction

The relations between the black hole mass (M_{BH}) and its host galaxy bulge properties such as luminosity L , stellar velocity dispersion σ_* and mass M , (Gebhardt *et al.* 2000, Graham 2007, Kotilainen *et al.* 2007), suggest a coeval black hole-host galaxy evolution. It is widely believed that the relativistic jet launched by the black hole might play an important role in this co-evolution, by heating and forcing the cold gas out of the bulge, thus affecting star formation. So the question arises: Is there any relation between the mass of a black hole and the jet it produces? To effectively address this issue, we need reliable M_{BH} estimations. Black hole masses can be estimated by assuming virialization of the clouds in the BLR. However, studies by Arshakian *et al.* 2010 and León-Tavares (2010, 2013) have shown that the gas in the BLR can be accelerated and ionized by non-thermal emission from the jet. Moreover, absorption features are swamped by non-thermal emission from the jet, thus making impossible to measure σ_* . Finally, the empirical relation between the M_{BH} and the bulge luminosity (L_{bulge}) can be used to obtain homogeneous and bias-free estimations of M_{BH} in the overall population of AGN with prominent relativistic jets.

2. $M_{BH} - jet$ relations

By using the $M_{BH} - L_{bulge}$ relations (Graham 2007), we estimate the M_{BH} of 29 radio loud AGN. Bulge luminosities were estimated by modeling the surface brightness of the host galaxy (figure 1) with GALFIT (Peng *et al.* 2011). Thus, allowing us to investigate the connection between M_{BH} and jet properties such as luminosity (Torrealba *et al.* 2012)

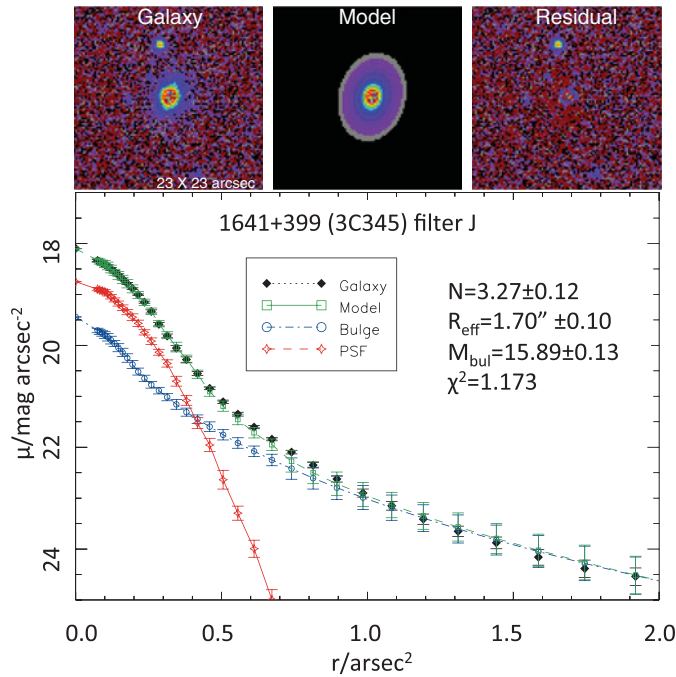


Figure 1. 2D surface brightness decomposition of 1641+399 (3C345) at J band taken with with the NIR camera NOTCam on the Nordic Optical Telescope (NOT). Top left subpanel: the observed image. Middle top subpanel: Shows the model used to describe the surface brightness distribution, which is a nuclear unresolved component (PSF) convolved with a Sérsic model. Right top subpanel: The residual image. Bottom: Radial profile of the surface brightness distribution.

and Lorentz factor (Hovatta *et al.* 2009). We find statistically significant correlations between M_{BH} , jet luminosity and Lorentz factor.

3. Implications

Statistically significant correlations found between M_{BH} and its jet in this work, strongly suggest that the more massive the black hole is, the faster and brighter the jet it produces. These result could be interpreted as an evolutionary connection between the black hole and its relativistic jet. Moreover, these relations could be useful to constraint high energy production models in radio-loud AGN. The manuscript reporting these findings in detail is under preparation.

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