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KINEMATICAL AND PHYSICAL PROPERTIES OF THE CENTRAL EMISSION REGIONS OF ACTIVE GALAXY Mrk 817

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Abstract. Active Galactic Nuclei (AGN) are among the most spectacular objects in the sky since they produce enormous amounts of energy in a tiny volume, having luminosities of $L \approx 10^{42} - 10^{48}$ erg s^{-1}. AGN emit in the continuum, as well as in the spectral lines, from γ and X-ray to the far infrared and radio domain. Their emission lines can be classified as narrow (NELs) or broad emission lines (BELs) according to their widths, and they are formed in two different emission regions, the narrow line region (NLR) and broad line region (BLR).

In this work we study the physical and kinematical properties of the emission line regions of Seyfert 1.5 galaxy Mrk 817. The spectrum of this AGN has both BELs and NELs, which show interesting substructures (such as shoulders or bumps), that classify this galaxy to be Seyfert 1.5 galaxy. The investigation is based on four sets of observations that are obtained with the following telescopes: 2.5m Isaac Newton Telescope and 4.2m William Herschel Telescope of the La Palma Observatory at Canary Islands, 2.6m Shain Telescope of the Crimean Astrophysical Observatory and 2m telescope of the Rozhen Observatory in Bulgaria (Ilić 2006, Ilić et al. 2006).

We find that in Mrk 817 the NELs and BELs are very complex, indicating that structure of both the NLR and BLR is stratified and consists of at least two sub-regions with different kinematical properties. The BELs of Mrk 817 can be fitted with the two-component model, where the core of the line is coming from a spherical region with isotropic velocity distribution, and wings are affected by a low inclined accretion disc (or disc-like emitting region). Our analysis of the disc parameters shows that the minimal inner radius of the disc cannot be smaller than 0.4 lt-days and that the disc should be smaller then 39 lt-days (for a black hole mass of $4.9 \times 10^7 M_\odot$), that is in the agreement with the results obtained by Kaspi et al. (2000), who estimated the dimensions of the BLR of Mrk 817 to be $\sim$ 15 lt-days. The inclination of the disc is small and in the range of $12^o < i < 35^o$, which is expected for the Seyfert 1.5 galaxies. The other region seems to be spherical with isotropic random velocity distribution. It is hard to estimate its dimensions, but one can conclude that it should not be significantly larger than the disc, since the random velocities in this region ($\sim 10^3$km s^{-1}) are very similar to the random velocities in the disc. Also, we discuss the physical properties of the BLR, using the Boltzmann Plot method (Popović 2003) and find that the BLR temperature is $\sim (1-2) \times 10^4$K, while the density tends to have higher value $n \sim 10^{14}$cm^{-3}. From the gaussian analysis of the NELs, we conclude that the NLR is also complex and consists of the NLR1, with widths $\sim$ 450km s^{-1}, and relative approaching velocity 400 km s^{-1} with respect to the systemic redshift of the galaxy, and the NLR2, with widths $\sim$ 150 km s^{-1}, and a redshift equal to the systemic one of Mrk 817. Since the inclination angle of the disc is relatively small it is likely that we observe this AGN along the approaching jet that emits only in the NLR1 (the outflow velocities should be higher for the factor of sin i). Therefore, the outflow seen in the NLR may be driven by an approaching jet (Ilić et al. 2006).

References

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