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L_{α} LINE IN THE MKN335 SEYFERT 1 GALAXY

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Abstract. The analysis of the L_{α} emission line profile of MKN 335 Seyfert 1 galaxy is presented. The line profile shows a prominent blue asymmetry (A=-0 18) For description of this asymmetry a model with outflow emission gas and gravitational redshift effect in Broad Line Region (BLR) are applied.

1. INTRODUCTION

The MKN 335 is a variable Seyfert 1 galaxy. The variability is noted in the continuum in the line fluxes (see, e.g., Shuder, 1981; Osterbrock and Shuder, 1982; Levshakov *et al.*, 1989) and in the x-ray flux, too (Lee *et al.*, 1987). But the shape of its emission spectral line profiles (H_{β}, H_{α}...) seems to remain constant, showing a blue asymmetry (Popov and Khachikyan, 1980; Osterbrock and Shuder, 1982; Crenshaw, 1986; Van Groningen, 1987). The line widths of MKN 335 are narrower than those of other Seyfert 1 galaxies.

Using IUE observations Wu *et al.* (1980) have measured the flux of L_{α} line of MKN 335, and found that it is about seven times larger than the H_{β} flux. But, as we know, detailed study of the L_{α} shape has not been done yet. There is an interest in L_{α} shape investigation in Seyfert 1 nuclei, because this line is originated close to the nuclei and the influence of the disk on its shape (especially on the wings (Nazarova, 1991; Van Groningen, 1987)) could be significant.

Using a set of Huble Space Telescope high resolution spectral observations of MKN 335 we analyze the shape of the L_{α} spectral line. We apply a model of MKN 335 that takes into account the outflow velocity of emission gas. The gravitational redshift effect, which has been noticed in BLR (Popović *et al.*, 1995), is taken into account, too. In this paper the preliminary results of our investigation are presented.

2. ANALYSIS AND RESULTS

2.1. THE L_{α} LINE SHAPE

Similarly as with Balmer lines (see Osterbrock and Shuder, 1982; Crenshaw, 1986) a blue asymmetry of the L_{α} line profile of MKN 335 is noticed (see Fig. 1). We have found that the asymmetry

$$A = \frac{(HWHM)_{red} - (HWHM)_{blue}}{(HWHM)_{red} + (HWHM)_{blue}}$$

at half maximum is -0.18 (HWHM is half width at half maximum). The full width at half maximum (FWHM) is 1380 km/s. In the L_α profile there are three absorption lines : $\lambda_1 = 1240.95$ Å, $\lambda_2 = 1250.47$ Å and $\lambda_3 = 1253.7$ with FWHM $w_1 = 0.4$ Å, $w_2 = 0.2$ Å and $w_3 = 0.2$ Å. The last two lines are probably orginated in the interstellar matter of our Galaxy and their wavelengths are near SiII ($\lambda\lambda$1250.43 Å), S II ($\lambda\lambda$1250.5 Å) and Li II or S II ($\lambda\lambda$1253.8 Å). Moreover, one should notice that the absorption lines may be originated from the galaxy.

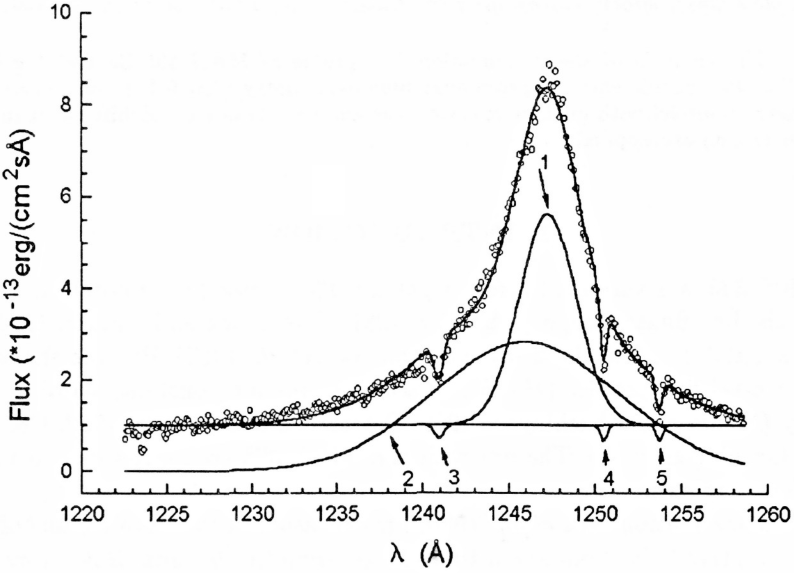

Fig. 1. The shape of observed L_α line (dots) and its Gaussian decomposition (full line).

2. 2. THE TWO-GAUSS-FIT APPROXIMATION

For more detailed analysis of the L_α line shape we use the method described in Vince *et al.* (1995).

In order to separate the Broad Line Component (BLC) from the Narrow Line Component (NLC) of the line, taking into account the consideration given by Corbin (1995), we fit the profile with two Gaussian components where the intensity, width and position of Gaussian components were free parameters. The best fit gives a separation of V_{em}=320 km/s between two Gaussian functions; the BLC is shifted toward blue. The blueshift of the BLC compared with NLC could be explained by Doppler effect of the outflow of emission gas. The turbulence velocity of the emission gas ($v_t = FWHM$ of Gaussian component/1.67) is about 350 km/s in the NLR and 1130 km/s in BLR.

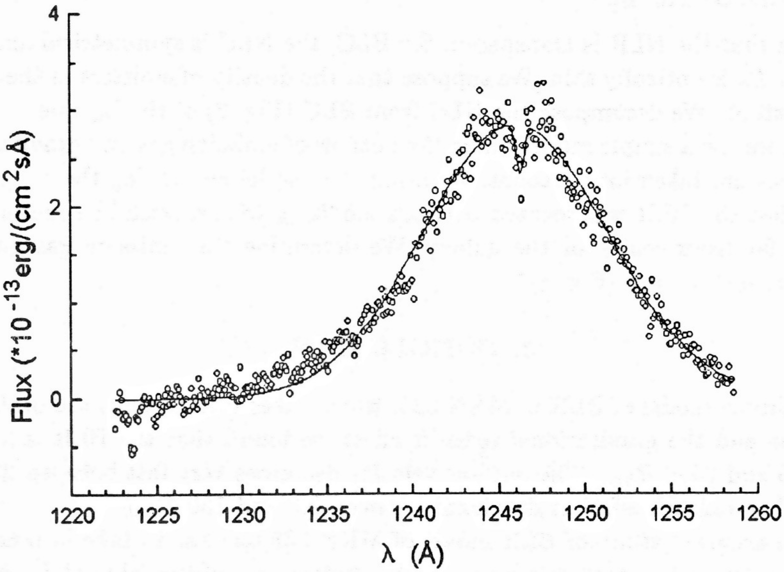

Fig. 2. BLC of the L_α line : dots are observed, full line is the synthetic profile where the outflow of matter and the effect of gravitational redshift were taken into account.

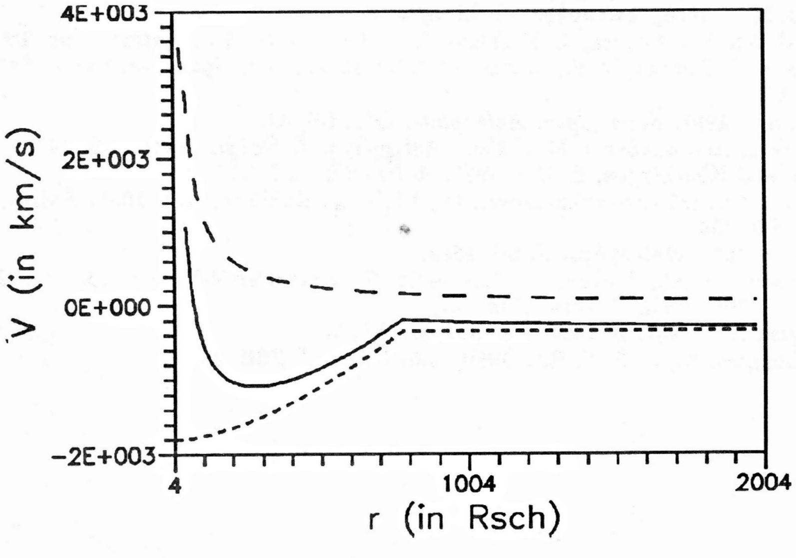

Fig. 3. The outflow gas radial velocity (- - -), the gravitational redshift (— —), and the resulting velocity distribution (—–) with distance.

2. 3. A MODEL OF THE BLR

We suppose that the NLR is transparent for BLC, the NLC is symmetrical and that the BLR for L_α is optically thin. We suppose that the density of emitters in the whole BLR is constant. We decompose the NLC from BLC (Fig. 2) of the L_α line.

For BLR we use a simple model where the outflow of emission gas and gravitational redshift effect are taken into account. By using this model and fitting the L_α profile, we found that the BLR was located between 2.5 R_{Sch} (Schwarzschild's radius) and 2000 R_{Sch} far from center of the galaxy. We determine the emission gas ejection velocity distribution, too (Fig. 3).

3. CONCLUSION

Using the simple model of BLR in MKN 335, which takes into account the outflow of emission gas and the gravitational redshift effect we found that the BLR is located between 2.5 and 2000 R_{Sch}. The outflow velocity decreases very fast between 2.5 and 780 R_{Sch}. The redshift effect is dominant between 2.5 and 150 R_{Sch}.

For more accurate study of BLR model of MKN 335 one has to take into account the selfabsorption effect that was noted in the central core of the BLC of L_α line.

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