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THE SPECTRAL LINE SHAPES OF MRK 1040 AND SMALL NEIGHBOURING GALAXY

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Abstract. The spectra of Mrk 1040 and UGC 01935 were observed with Isaac Newton Telescope (INT) on January 24 and 25 at the same time (both object were in the slit). We have analyzed the H_β and H_α emission line shapes and shifts of these two Active Galactic Nuclei (AGNs).

1. Introduction

Mrk 1040 is a Seyfert 1 galaxy (z=0.016) (Reynolds et al. 1995), with a companion galaxy UGC 01935 distant about 20" to the north along the minor axis (Colbert et al. 1996). The compact object is clasified as S01 type G.

In this paper we present our observations of H_α and H_β emission line spectral regions of these galaxies.

2. Observation and data reduction

Mrk1040 and UGC 01935 were observed with 2.5 m Isaac Newton Telescope at La Palma, in the period between 21th and 25th of January. The observation contained Balmer series of emission lines. We observed the spectra around H_α

and H_β line of both objects within the same slit. The slit was 1". The Intermediate Dispersion Spectrograf (IDS) and the 235 camera in combination with the R1200y greating were used.

Each set of observations contained 3 spectra with exposure time of 1400 sec. CuNe and CuAr lamps were used for wavelength calibration. Reduction of data was performed using IRAF and DIPSO software packages.

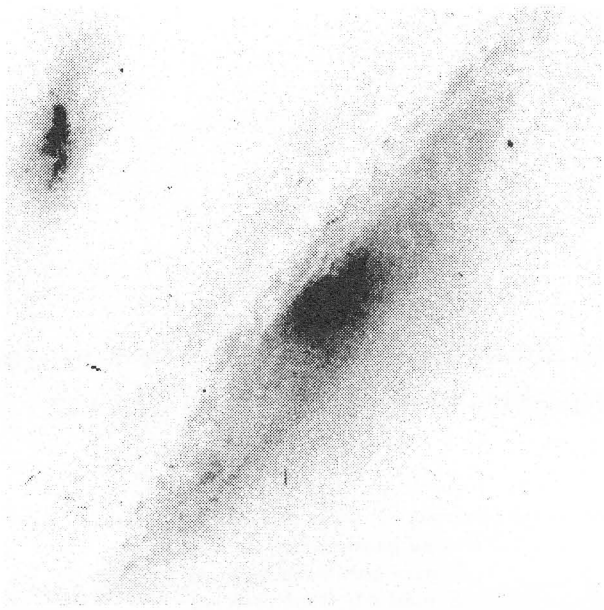

Fig. 1: Mrk 1040 and UGC 01935 photo from Palomar 48-inch Schmidt telescope (Ref. NED)

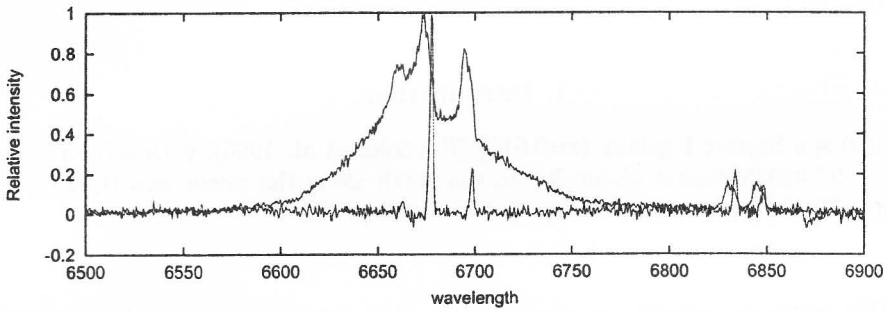

Fig. 2: Comparison of $H\alpha$ line of MRK 1040 and UGC 01935

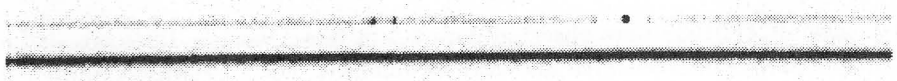

Fig. 3: Spectra around $H\alpha$ line of Mrk1040 and UGC 01935 within the same slit

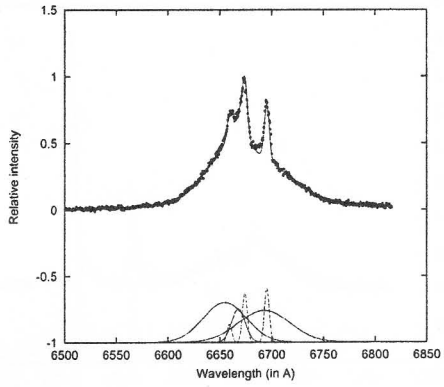

Fig. 4: Decomposition of the H_α line. The dots present observation and solid line is the best fit obtained by Gaussian decomposition. The Gaussian components are shown at the bottom of the figure

Mrk1040: The H_α can be decomposed into four Gaussian components; three broad ones and one narrow. Narrow component has the same width (w) and shift (z) as N II lines $\frac{w}{\lambda} = 0.0005$ ($w = 150\frac{km}{s}$), and $z = 0.01697$. The three broad Gaussian components have parameters: a) blueshifted with respect to cosmological redshift $w = 1350\frac{km}{s}$, $z = 0.014$; b) central $w = 430\frac{km}{s}$, $z = 0.016$; c) redshifted with respect to cosmological redshift $w = 1620\frac{km}{s}$, $z = 0.0198$.

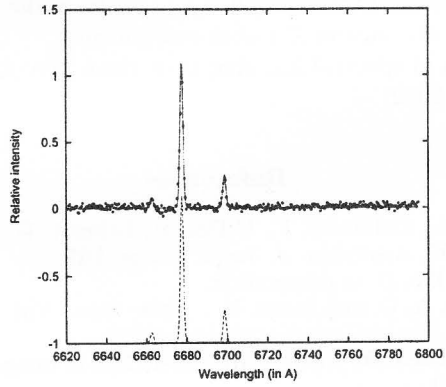

Fig. 5: The same as in Fig. 4. but for the UGC 01935 H_α line

UGC 01935: The $H\alpha$ and N II lines have the same redshift and width and can be represented by one Gaussian component with parameters: $w = 50\frac{km}{s}$, $z = 0.0175$. Weak apsorbtion lines at the $z = 0.0169$ from Mrk 1040 are present.

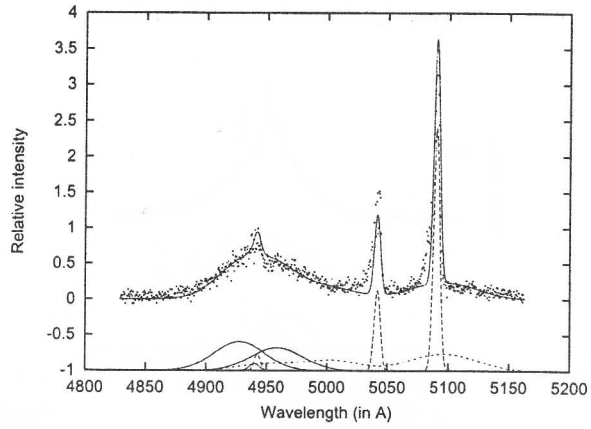

Fig. 6: The same as in Fig. 4. but for the H_β profile of Mrk 1040. The dashed complex line at the bottom represents combination of Fe II complex

3. Results

As one can see in Fig 2. the redshift of the UGC 01935 is higher ($z = 0.0175$) than that of Mrk 1040. Using their redshift and assuming that $H_0 = 50\frac{km}{s}/Mpc$, $\Omega_0 = 1$, we obtained that the distance between these galaxies is about 3.4 Mpc. The line shape of MRK 1040 H_α is typical for Sy 1 galaxy, while line width of UGC 01935 H_α is characteristic for LINERs.

As one can see from Figs 4-6 the H_β and H_α lines of Mrk 1040 are very complex and can be decomposed into three broad components, while the lines of UGC 01935 can be represented by one narrow Gausian component.

Detailed discussion of spectral line shapes of these two objects will be given elsewhere (Popović et al. 2002)

References

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