SIMILARITY OF EMISSION LINES OF ACCRETING WHITE DWARFS AND QUASARS

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Here we show striking similarities between the emission lines of two accreting white dwarfs with jets (CH Cyg and MWC 560) and the active galactic nuclei (AGN), in spite of the mass difference (a typical black hole in Seyfert galaxies has a mass $\sim 10^6 - 10^9\ M_\odot$ and the accreting white dwarfs $\sim 1\ M_\odot$). Practically almost every emission line visible in the spectrum of the quasar I Zw 1 (widely used as template for AGN spectra) has corresponding features in the spectra of CH Cyg and MWC 560. An obvious similarity is visible also between the UV spectra.

The hydrogen emission lines as well as the FeII emissions of AGN are emitted from the so-called broad line region. This region is thought to be within ≤ 1 pc from the central BH. Its structure is poorly understood as yet. The clear similarity between the emission lines means that, in objects like MWC 560 and CH Cyg, we are observing a scaled down version of the famous broad line region of the quasars.

During the last decade, several investigations of AGN emission lines emphasized the importance of a set of correlations conventionally called "Eigenvector 1". This diagram is believed to have a significance for AGN similar to the one of Hertzsprung-Russell diagram for stars [1]. The physical drivers can be accretion rate, orientation, and the black hole mass [2, 3].

We want to use the emission line similarity to understand better this correlation space. The investigations of the last years [2, 4] gives us the possibility to create theoretical grid over the optical Eigenvector-1 diagram (see the right panel of Fig.1). As it can be seen, the positions of MWC 560 and CH Cyg is very close to those predicted from the extrapolation of the assumed quasar relationships. The used quasar relations correctly predict that the luminosity of these two objects should be considerably less than the Eddington luminosity for a white dwarf. In reality the total luminosity of the white dwarf of CH Cyg during the spring of 1984 is $L \leq 1000\ L_\odot$ and of MWC 560 is $L \approx 1000\ L_\odot$ (in November-December 1998). Assuming a

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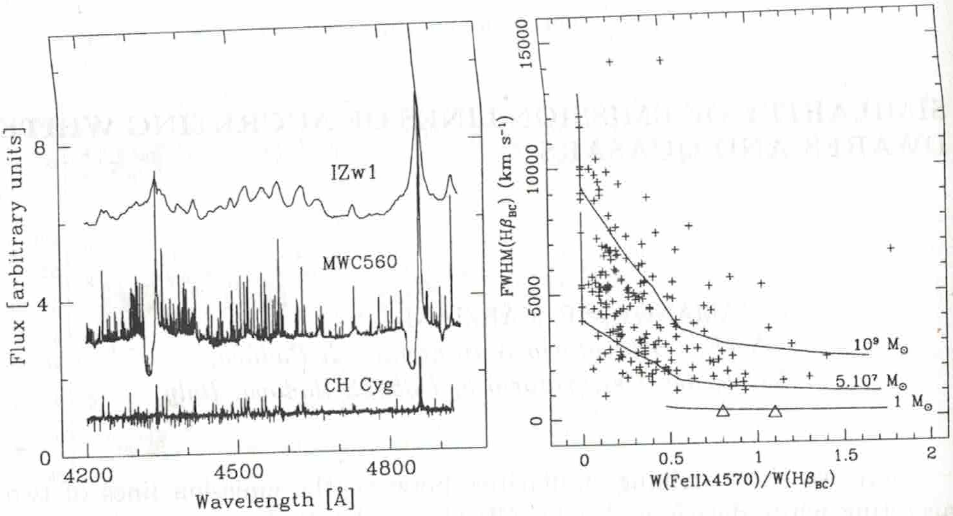

Figure 1. **(left panel):** A comparison between the optical spectra in the $H\gamma$ - $H\beta$ region of the interacting binaries CH Cyg, MWC 560 and the low redshift quasar I Zw 1. A clear similarity between the emission lines is visible. Despite the general similarity some differences are visible as well. In MWC 560 these are the absorption components in the Balmer lines. These absorptions are due to the jet coinciding with the line of sight. They are also dominating the UV spectrum of MWC 560 making it quite different from the ones of CH Cyg and I Zw 1. In the optical spectrum of CH Cyg numerous absorptions due to the photosphere around the white dwarf are visible. **(right panel):** The optical Eigenvector 1 diagram. The plus signs represent our quasar sample, the triangles - the two white dwarfs with quasar-like spectra. The theoretical lines are plotted for black hole mass 10^9 and 5×10^7 $M_\odot$, and white dwarf mass 1 $M_\odot$.

typical white dwarf mass in symbiotic stars of $M_{WD} = 1.0 - 1.4\ M_\odot$, we obtain $(L/M) \approx 10^3$ in solar units, in agreement with parameters used to plot the lowest line in Fig.1. In this way the position of MWC 560 and CH Cyg reinforces the interpretation of the Eigenvector-1 correlation space as mainly driven by L/M ratio.

It seems that the similarity between accreting white dwarfs and quasars can be extended, for example the nova-like variable RW Sex has profile of CIVλ1549 line very similar to the mini broad absorption line quasar PG 1411+442 [5]. Further details are reported in [6, 5]

References

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