Accretion Disks of Binary Stars as a Probe to Accretion Disks of other Astrophysical Objects.

By
Romanus Nwachukwu Eze
Department of Physics and Astronomy,
University of Nigeria, Nsukka,
Enugu State, Nigeria.
E-mail rnceze@yahoo.com

Abstract.

The understandings of the processes that led to accretion in astrophysical objects have been a central problem for some decades now. However, we have a more detailed knowledge of binary disks accretion process because, first there are large number of such systems within 100 pc; and such proximity allows fainter spectral features to be analyzed. Secondly, the primary star in a binary can sometimes be used as probe, eclipsing portions of the disks at different times, thereby allowing disks properties to be mapped. Finally, accretion disks occur over a time scale convenient for observational monitoring and much can be leaned by studying the evolving spectra. In this work an attempt has been made to use the results from spectral analyses of the accretion disks of cataclysmic variables to make generalization on accretion disks of other astrophysical objects.

Summary of the work

Accretion disk is believed to be the source of energy in the vicinity of cataclysmic variables CVs, X-ray binaries, Young stellar objects and the AGN. Energy production occurs if materials lose angular momentum by transporting it outwards so that it can sink lower in the gravitational potential well of the central object.

The central problem of nearly 30 years of accretion disk theory has been to understand how they accrete (That is how materials are transferred from the accretion disk to the accreting object). In principle, the presence of friction in the form of viscosity allows the exchange of angular momentum between adjacent fluid elements, but this fails to account for the observed accretion rates. If on the other hand, the disk were turbulent, the effective viscosity could be large enough to provide the needed accretion rates. Magneto rotational instability provides a robust and self-consistent mechanism for the production of turbulence and angular momentum transport in these objects if they are adequately ionized.

Analyses of some astrophysical data from satellite in the Extreme Ultraviolet region of the accretion disks of cataclysmic variable were also carried out. We were able to identify a number of strong emission lines in 14 CVs. We discovered that most CVs follow similar trend in the amount of ionized element/iron present in their spectrum but some have very few or no ionized elements/iron in their spectrum. The AM Herculis star, which has the weakest magnetic field of all the seven magnetic CVs studied contain no ionized elements in its EUVE spectroscopy. We were unable to identify why this is so with the AM Herculis star. However, for the rest of the CVs, we have sufficient evidence to conclude that the accretion disks of CVs are highly ionized. This implies also that the accretion disks of other astrophysical objects could be equally highly ionized. This result is in agreement with the suggestion that the most promising candidate for providing the angular momentum transport mechanism during the outburst is magneto hydrodynamics turbulence.