New magnetic cataclysmic variable star discovered

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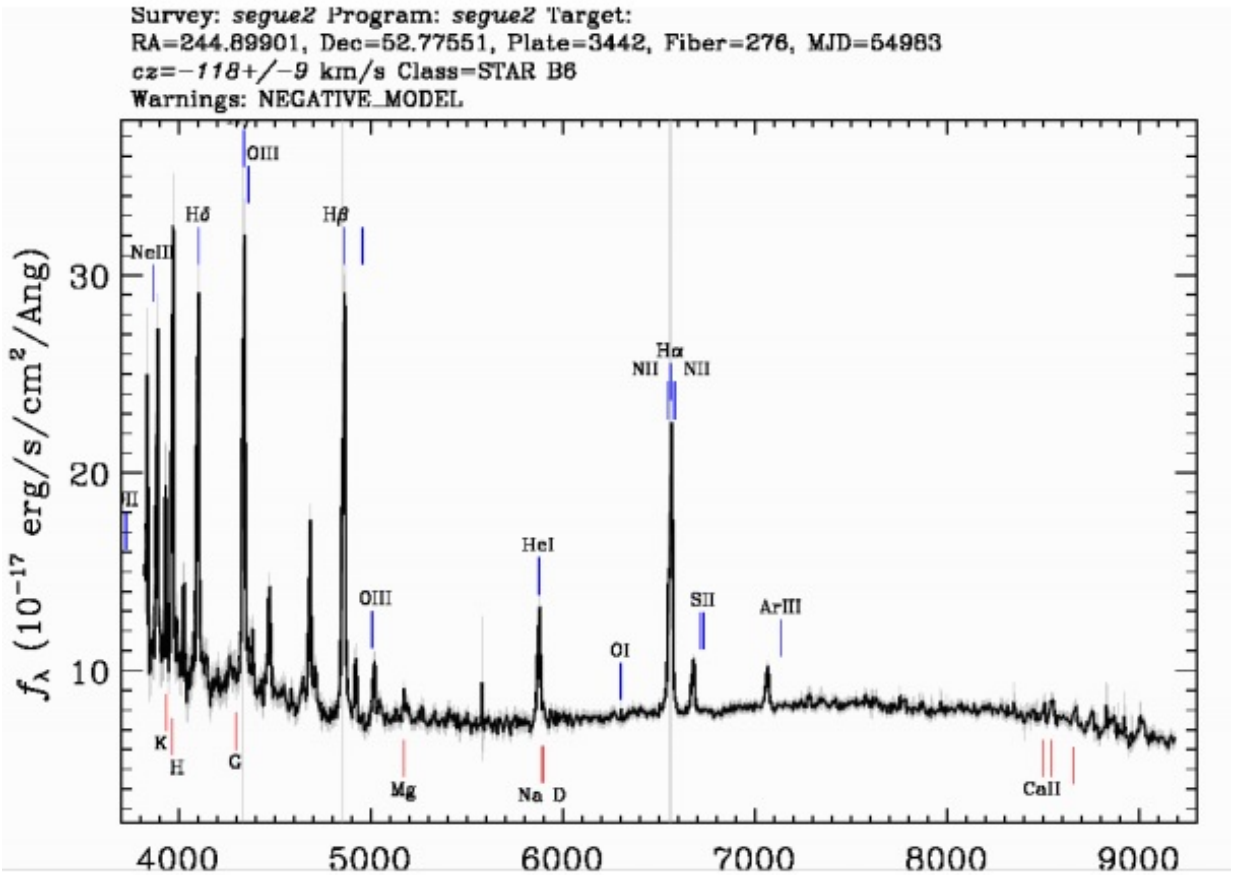

SDSS spectrum of 1RXS J161935.7+524630 taken on 2009 June 01. Credit: Denisenko and Martinelli, 2016.

(Phys.org)—A new magnetic cataclysmic variable (CV) star has been

detected by astronomers in the constellation of Draco. The newly found object, designated DDE 32, exhibits a large amplitude variability with one of the shortest orbital periods - about 100.5 minutes. The findings are reported in a paper published Sept. 27 on the arXiv pre-print server.

CVs are binary star systems consisting of a white dwarf and a normal star companion. They irregularly increase in brightness by a large factor, then drop back down to a quiescent state. One subclass of CVs, called polars, comprises cataclysmic variables with strong magnetic fields. DDE 32 was found to be such a polar, with the accretion mode changing from one pole to two poles.

DDE 32, first identified by the ROSAT space observatory as an X-ray source in December 2007, was initially designated 1RXS J161935.7+524630. At the moment of its detection, the nature of this source was unclear and it was considered to be too red for a cataclysmic variable. Therefore, its re-classification was neglected for nearly four years.

Now, Denis Denisenko of the Moscow State University in Russia and Fabio Martinelli of the Lajatico Astronomical Centre in Pisa, Italy, have re-designated 1RXS J161935.7+524630 to DDE 32, revealing its magnetic cataclysmic variable behavior. Their conclusion was based on the follow-up observations conducted since 2011 and on the analysis of the data collected by the Sloan Digital Sky Survey (SDSS).

"Despite the 10-years-long experience in identifying X-ray sources and finding cataclysmic variables by many different methods, this one has deceived me at first and escaped the correct identification for several years," Denisenko told Phys.org.

The researchers revealed that DDE 32 is a new polar with an orbital period of nearly 0.07 days (100.5 minutes) and changing geometry of

accretion. The object experiences a large amplitude (nearly 2 magnitudes) variability and its accretion mode changed from one pole before 2014 to two poles in 2015.

"Every cataclysmic variable has its own 'cataclysms' and its own unique way of changing behavior with time. Of course, DDE 32 is not the first CV known to change accretion regime from one pole to the other, or to both poles at once. But it is one of the systems like that with the shortest period, and it's changing the shape of light curve on rather short time scales. It is those quick changes that make it very useful in understanding the processes in cataclysmic binaries," Denisenko noted.

However, many parameters of DDE 32 are yet to be determined, especially when it comes to the system's white dwarf. At the moment, the scientists don't know its mass, magnetic field, and even rotation period.

Moreover, DDE 32 needs to be assigned to one of several polar subtypes: AM Her ("classical" polars), BY Cam (asynchronous polars) and DQ Her (intermediate polars). Further studies are required to measure the rotation period of the polar's white dwarf in order to verify its classification.

"I have made some hypotheses that proved to be wrong with time and with more data becoming available. Since I have limited access to the state-of-art astronomical equipment, especially to the spectroscopic one, I encourage the more detailed study of those objects that stand out from the general CV population. Even if those studies will ultimately prove I was wrong," Denisenko concluded.

More information: 1RXS J161935.7+524630: New Polar with the Varying Accretion Modes on two Magnetic Poles, arXiv:1609.08511 [astro-ph.SR] arxiv.org/abs/1609.08511

Abstract
We report the discovery of a new cataclysmic variable DDE 32 identified with the ROSAT X-ray source 1RXS J161935.7+524630 in Draco. The variability was originally found by D. Denisenko on the digitized Palomar plates centered at the position of X-ray source. The photometric observations by F. Martinelli at Lajatico Astronomical Center in June 2015 have shown the large amplitude (nearly 2 magnitudes) variability with a period about 100.5 minutes. Using the publicly available Catalina Sky Survey data from 2005 to 2013 we have improved the value of period to 0.0697944 days. Comparison of the archival CRTS data with more recent observations from Lajatico shows the dramatic changes in the light curve shape. Instead of a single peak present in Catalina data before 2014, there were two peaks of nearly the same height during 2015. SDSS spectrum taken in June 2009 shows prominent Helium emission lines between the bright Balmer series. He II 4686 AA line has more than 30% effective width compared to H_beta line. All those features allow us to interpret 1RXS J161935.7+524630 as a magnetic cataclysmic variable (polar) with the accretion mode changing from one pole before 2014 to two poles in 2015.

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