MOST microsatellite reveals true nature of mysterious dust-forming Wolf-Rayet binary CV Ser

May 31 2011

(PhysOrg.com) -- Using the Canadian MOST microsatellite, a team of researchers from the Universite de Montreal and the Centre de Recherche en Astrophysique du Quebec has made a stunning observation. As they'll report at this week's CASCA 2011 meeting in Ontario, Canada, the team has observed significant changes in the depth of the atmospheric eclipses in the 30-day binary WR+O system CV Serpentis, suggesting a never before seen change of mass-loss rate of the WR component by 70%.

Intrinsically luminous stars, like those in CV Ser, are the ecological motors of the Universe. They include both massive stars (i.e., those that explode as supernovae after driving strong winds all their lives) and medium-mass stars (about 1-8 M_Sun, that increase their luminosity by a factor of 1,000 only during their last dying stages before ejecting their extended outer layers in what astronomers call planetary nebulae). Massive stars are relatively rare, but they make up for this by their extreme luminosities and winds.

Among massive stars, the most interesting stage is arguably the last 10% in the lifetime of the star, when hydrogen fuel is used up and the star survives by much hotter He-burning. This is the so-called Wolf-Rayet stage, named after the two French astronomers that discovered the first stars of this type in 1867 using a small telescope in Paris equipped with a spectroscope. Wolf and Rayet were astonished by the intense, broad

emission lines arising in their ultra-strong hot stellar winds.

Towards the end of the WR phase, the products of He-burning (mainly carbon atoms) eventually reach the stellar surface and are blown off in the wind. WR stars in this stage are called WC stars (in contrast to WN stars, where the N-rich products of H-burning are still spewing out). Some WC stars are known to produce copious quantities of carbon-based dust, i.e., conglomerates of many C atoms stuck together in amorphous dust grains ranging in size from a few to millions of atoms. How dust forms in general is one of the mysteries of the cosmos, but most astronomers believe that it requires high pressure and less than high temperatures, making it even more of a mystery how hot WC stars can do it. But they do, so it behooves astronomers to examine key cases for clues.

One key case is undoubtedly the sporadic dust-producing WC star in CV Ser. MOST was recently used to monitor CV Ser twice (2009 and 2010), revealing remarkable changes in the depths of the atmospheric eclipse that occurs every time the hot companion's light is absorbed as it passes through the inner dense WC wind. The remarkable, unprecedented 70% change in the WC mass-loss rate might be connected to dust formation.

Provided by Canadian Astronomical Society