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A New Predicted Class of Astrophysical Sources: White Dwarf Binary Mergers Poised for Discovery at The Vera Rubin Observatory

Press Release

Astrophysicists are about to take an important step forward: recent research that will be published in The Astrophysical Journal anticipates that the Vera Rubin Observatory (VRO), scheduled to release the first public data in 2025, will be able to observe a new type of astrophysical source: the merger of binary systems of white dwarfs. The research was conducted by an Italian team from the International Center for Relativistic Astrophysics Network (ICRANet) and the University of Ferrara, associates of the National Institute of Astrophysics (INAF), together with Brazilian colleagues from the Instituto Nacional de Pesquisas Espaciais (INPE), the Universidade Federal do Espírito Santo (UFES), and the Universidade Tecnológica Federal do Paraná (UTFPR).

In some cases, it is believed that mergers of binary white dwarfs occur in a completely destructive way, producing a supernova explosion called Ia. These supernovae are regularly observed from distant galaxies. However, many of these mergers can follow a different fate: they form a massive white dwarf with an associated transient source less luminous than a supernova and with a more rapid evolution. Although they are estimated to be very abundant, these less catastrophic mergers have escaped any observation by current telescopes, as they are not sufficiently sensitive. The research predicts that the emission produced by mergers of binary systems of white dwarfs, in wavelengths from infrared to ultraviolet, will be observed by VRO with an astonishing frequency, up to a thousand per year!

The light source emitted by the material expelled at high speed (about 1000 km/s) with temperatures of 100 thousand degrees for a few hours, is 10 to 100 million times brighter than the Sun. However, the rapid expansion causes the material to cool quickly, making their identification elusive. The most exciting result of the research is that, by putting together the expected population of these mergers and their emission characteristics, the researchers estimated that VRO, equipped with cutting-edge instrumentation and a wide field of view, is ready to discover these mergers in great abundance. Observing these stellar mergers will allow unprecedented insights into their birth and evolution if the predictions are confirmed. The authors say such observations will profoundly impact our knowledge of astrophysical phenomena linking massive white dwarfs to the formation of neutron stars. They will also provide crucial information on the possible generation of Type Ia supernovae from binary white dwarf mergers.

To the various types of transient sources that VRO is preparing to discover in abundance, we add the merger of binary systems of white dwarfs, whose observations will offer a revolutionary contribution to the knowledge of the life and evolution of these types of stars, including the genesis of ultraintense magnetic fields.

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Reference article:

On the optical transients from double white-dwarf mergers
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