

Researchers find different evolutionary pathways for two subtypes of contact binaries

April 9 2020, by Liu Jia

Secondary components of W UMa-type contact binaries exhibit an excess in radius and luminosity. Based on these two properties, Ph.D. student ZHANG Xudong, Prof. QIAN Shengbang, and Dr. LIAO Wenping from Yunnan Observatories of the Chinese Academy of Sciences revealed the different evolutionary pathways for A- and W-subtype contact binaries. Overluminosity in the A subtype is because the secondary components evolved from initially more massive stars, while in the W-subtype it is due to energy transfer. The study was published in *Monthly Notices of the Royal Astronomical Society*.

The researchers compiled a list of 117 contact binaries in this study, including 48 A subtype samples and 69 W subtype samples, and measured their spectroscopic and photometric parameters.

By comparing the radial density distribution between secondary components of these samples and main-sequence [stars](#), they found that A-subtype contact binaries have some evolutionary relationship with main-sequence stars whose masses are higher than 1.8 Msun. In other words, A-subtype contact binaries are evolved from stars which have initial masses higher than 1.8 Msun and experience mass ratio reverse.

However, the different Mass-Luminosity relation between two subtypes indicated another possibility for the W-subtype secondaries.

The researchers found that for W-subtype contact binaries, luminosity increase of secondaries and luminosity decrease of primaries show linear

relation. The linear relation indicated that [energy transfer](#) leads to their excess in radius and [luminosity](#). This is also in agreement with thermal relaxation oscillation (TRO) theory. The W-subtype contact binaries may have experienced one or several TRO cycles.

This study sheds new light on the formation and evolution of A- and W-subtype contact binaries.

More information: Xu-Dong Zhang et al. Different evolutionary pathways for the two subtypes of contact binaries, *Monthly Notices of the Royal Astronomical Society* (2020). [DOI: 10.1093/mnras/staa079](https://doi.org/10.1093/mnras/staa079)

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