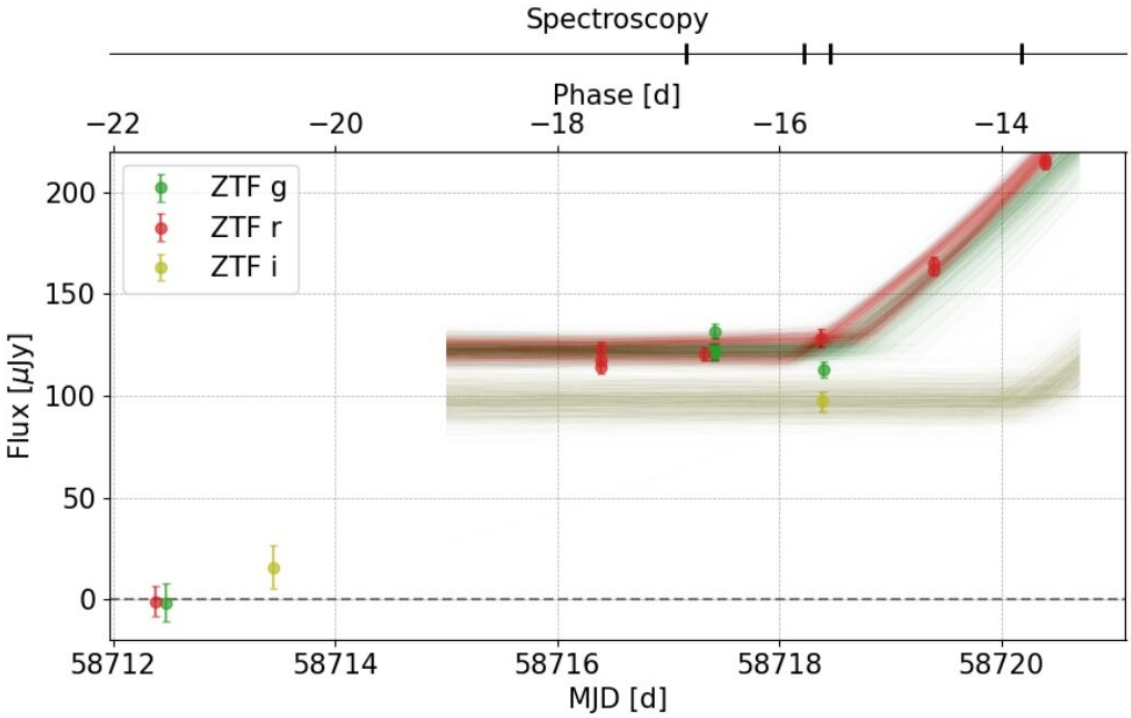
SN 2019odp is a massive oxygen-rich Type Ib supernova, study finds

April 3 2023, by Tomasz Nowakowski



Photometric evolution of SN 2019odp around the discovery epoch. Credit: Schweyer et al, 2023

An international team of astronomers has conducted follow-up photometric and spectroscopic observations of a supernova designated SN 2019odp. Results of the observational campaign, published March 24 on the *arXiv* pre-print server, indicate that SN 2019odp is a massive and

oxygen-rich supernova of Type Ib.

Supernovae (SNe) are powerful and luminous stellar explosions. They are important for the scientific community as they offer essential clues into the evolution of stars and galaxies. In general, SNe are divided into two groups based on their atomic spectra: Type I and Type II. Type I SNe lack hydrogen in their spectra, while those of Type II showcase spectral lines of hydrogen.

Type Ib supernovae (SNe Ib) are a subclass of stripped-envelope core-collapse SNe. They are formed when a massive star, with its outer envelope of hydrogen stripped away, collapses under its own gravity. SNe Ib could be crucial to improve our understanding of the evolution of massive stars, post-explosion interaction, and properties of resulting supernovae. The presence of helium further distinguishes between the helium-rich Type Ib SNe and the helium-poor Type Ic.

SN 2019odp, also known as ZTF19abqwtfu, was discovered on August 21, 2019, as part of the Zwicky Transient Facility survey (ZTF). The supernova is located some 208 million light years away, in the spiral galaxy UGC 12373. Shortly after its discovery SN 2019odp was initially classified as a Type Ic-BL (broad-lined) supernova as part of the ePESSTO+ survey.

Now, new observations made by a group of astronomers led by Tassilo Schweyer of Stockholm University in Sweden suggest that SN 2019odp should be reclassified as a Type Ib supernova.

"We present and analyze observations of the Type Ib supernova (SN) 2019odp (a.k.a. ZTF19abqwtfu) covering epochs within days of the explosion to the nebular phase at 360 d post-explosion. ... Our observations include photometric observations mainly in the optical and low to medium-resolution spectroscopic observations covering the

complete observable time-range. We expand on existing methods to derive oxygen mass estimates from nebular phase spectroscopy," the researchers wrote in the paper.

The observations detected the presence of helium in the ejecta of SN 2019odp, what suggests the Type Ib nature. Moreover, the spectra showcase lines with much smaller line widths than typically associated with Type Ic-BL supernovae, further supporting the Type Ib scenario.

However, the pre-peak spectra of SN 2019odp have great spectral similarity to Type Ic-BL supernovae as well as other transitional SNe. This, according to the astronomers, may suggest a common scenario for all these supernovae early on.

The study also found that SN 2019odp is a high-mass oxygen-rich supernova as its ejecta mass was estimated to be 4–7 solar masses and its oxygen mass was calculated to be at least 0.5 solar masses. Therefore, the results point to a progenitor, most likely a Wolf-Rayet star with a pre-explosion mass higher than 18 solar masses.

More information: T. Schweyer et al, SN 2019odp: A Massive Oxygen-Rich Type Ib Supernova, *arXiv* (2023). DOI: 10.48550/arxiv.2303.14146

© 2023 Science X Network

Citation: SN 2019odp is a massive oxygen-rich Type Ib supernova, study finds (2023, April 3) retrieved 25 June 2024 from https://phys.org/news/2023-04-sn-2019odp-massive-oxygen-rich-ib.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.