Study confirms that stellar novae are the main source of lithium in the universe

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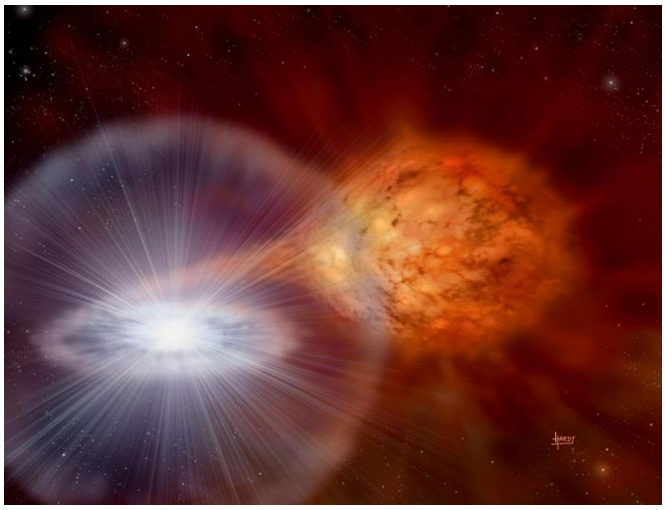

Artist's concept of a binary system similar to the one that originated the nova Sagittarii 2015 N.2. Credit: David A. Hardy y PPARC

Lithium, the lightest solid element, is created during astrophysical phenomena, but its origin has been elusive. Recently, a group of researchers detected enormous quantities of beryllium-7, an unstable element that decays into lithium in 53.2 days, inside nova Sagittarii 2015 N.2, which suggests that novae are the main source of lithium in the galaxy.

Practically every chemical element has an astronomical origin. Light elements were formed between 10 seconds and 20 minutes after the Big Bang, including hydrogen (75%), helium (25%) and a very small amount of lithium and beryllium.

The remaining chemical elements were formed in stars, either through fusion of other elements inside the nucleus, which begins with the fusion of hydrogen into helium, and produces increasingly heavy elements until iron forms. Other processes such as supernovae explosions or reactions in the atmospheres of giant stars produce gold, lead and copper, among others. Those elements were in turn recycled into new stars and planets, until the present time.

Luca Izzo, researcher at the Institute of Astrophysics of Andalusia (IAA-CSIC), says, "But lithium posed a problem: We knew that 25 percent of existing lithium comes from primordial nucleosynthesis, but we were not able to trace the origins of the remaining 75 percent."

Solution to the lithium enigma

The solution to the enigma of the origin of lithium lies, according to this study, in the novae, explosive phenomena occurring in binary star systems in which one of the stars is a white dwarf. The white dwarf can nab material from its twin star and form a superficial layer of hydrogen which, when it reaches a certain density, will trigger a nova, which can increase the brightness of the star up to 100 thousand times. After a few weeks, the system stabilizes and the process starts again.

Credit: Instituto de Astrofísica de Andalucía

The researchers studied nova Sagittarii 1015 N.2 (also known as V5668 Sgr), which was detected on March 15th, 2015, and remained visible for more than 80 days. The observation, made with the UVES instrument of the Very Large Telescope (ESO) in the course of 24 days, made it possible for the first time to follow the evolution of the beryllium-7 signal inside a nova and to calculate the amount present. "Beryllium-7 is an unstable element that decays into lithium in 53.2 days, so its presence is an unequivocal sign of the existence of lithium," says Christina Thöne, researcher at the Institute of Astrophysics of Andalusia (IAA-CSIC).

The existence of beryllium-7 had been previously documented in another nova, but the measurement of the amount of lithium produced from nova Sagittarii 1015 N.2 came as a surprise. "We're talking about an amount of lithium 10 times greater than that in the sun," says Luca Izzo (IAA-CSIC). "With these amounts in mind, two similar novae a year would suffice to account for all the lithium in the Milky Way. Novae seem to be the predominant source of lithium in the universe," he concludes.

More information: P. Molaro et al. Highly enriched ^{7}Be in the ejecta of Nova Sagittarii 2015 No. 2 (V5668 Sgr) and the Galactic ^{7}Li origin, *Monthly Notices of the Royal Astronomical Society: Letters* (2016). DOI: 10.1093/mnrasl/slw169

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