# Stellar dinosaurs in the prehistory of the Solar System

Prehistoric dinosaurs and the time when they were roaming the Earth have been discovered thanks to the bones we find and their radioactive content. In the same way, stars that lived before the formation of the Solar System and the time when they died have been discovered thanks to the radioactive imprint they left in the very first solids that formed in the Solar System.

A team led by Maria Lugaro, a Momentum project leader of the Hungarian Academy of Sciences at Konkoly Observatory in Budapest, in collaboration with other Hungarian, Italian, and German astrophysics and nuclear physics researchers, has used two radioactive nuclei to discover two stellar dinosaurs. These two nuclei are special because they are heavy and have a relatively low number of neutrons. One is a form of the element niobium (Nb) with 41 protons and 51 neutrons, the second of the elements samarium (Sm) with 62 protons and 84 neutrons. For comparison, most of the samarium in the Universe contains 90 neutrons. Because of their peculiarity, these nuclei can be produced only by some particular chains of nuclear reactions that can enrich matter in protons relatively to neutrons. These can occur only in some particular types of supernova explosions.

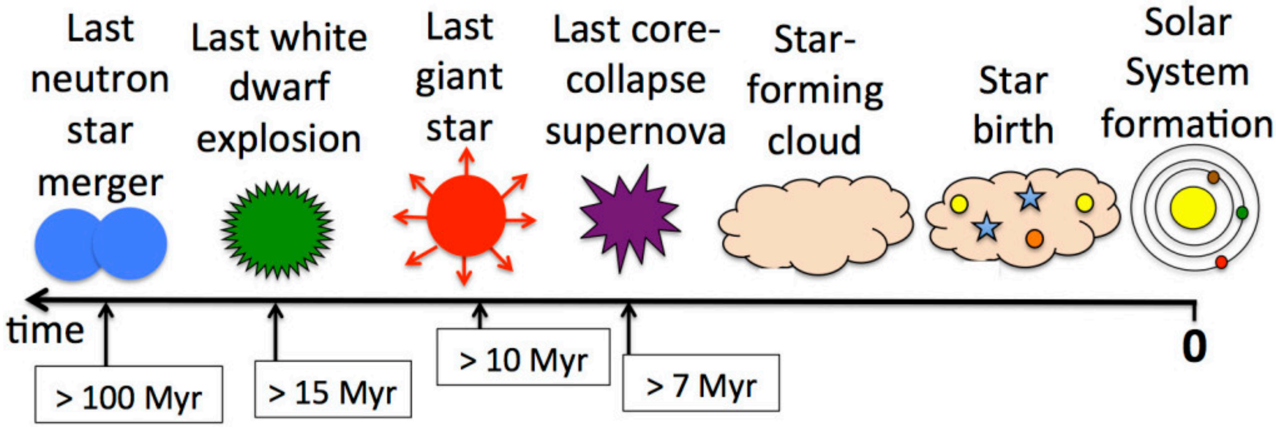


Fig. 1.

Using detailed computer models of such explosions, the team derived how much of these nuclei were produced and compared them to how much of them we find at the birth of the Sun. This allowed them to obtain a radioactive dating: the last supernova resulting from the explosion of a white dwarf occurred at least 15 million years before the birth of the Sun, while the last supernova resulting from the collapse of a star of initial mass of roughly 15 solar masses occurred at least 7 million years before the birth of the Sun. So far, no stellar dinosaurs have been found to die closer in time to the birth of the Sun. This means that the region where the Sun was born must have lived for a relatively long time, which is possible only if it was very massive. It may well be that our Sun was born in a huge, massive stellar nursery with thousands of stellar siblings that have since then dispersed in the Galaxy. Searches to identify the long-lost solar family today may be feasible thanks to the Gaia space observatory of the European Space Agency, currently observing precisely the properties of a billion stars.

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## Publication

Origin of the p-process radionuclides 92Nb and 146Sm in the early solar system and inferences on the birth of the Sun.
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