

Two neutron stars collided near the solar system billions of years ago

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If a comparable event happened today at a similar distance from the solar system, the ensuing radiation would outshine the entire night sky. Credit: Szabolcs Marka

Astrophysicists Szabolcs Marka at Columbia University and Imre Bartos at the University of Florida, have identified a violent collision of two neutron stars 4.6 billion years ago as the likely source of some of the most coveted matter on Earth.

This single cosmic event, close to our solar system, gave birth to 0.3 percent of the Earth's heaviest elements, including gold, platinum and uranium, according to a new paper appearing in the May 2 issue of

Nature.

"This means that in each of us we would find an eyelash worth of these elements, mostly in the form of iodine, which is essential to life," Bartos said. "A wedding ring, which expresses a deep human connection, is also a connection to our cosmic past predating humanity and the formation of Earth itself, with about 10 milligrams of it likely having formed 4.6 billion years ago."

"Meteorites forged in the [early solar system](#) carry the traces of radioactive isotopes," said Bartos, who received his Ph.D. at Columbia.

"As these isotopes decay they act as clocks that can be used to reconstruct the time they were created," Marka said.

To arrive at their conclusion, Bartos and Marka compared the composition of meteorites to numerical simulations of the Milky Way. They found that a single neutron-star collision could have occurred about 100 million years before the formation of Earth, in our own neighborhood, about 1000 light years from the gas cloud that eventually formed the Solar System.

The Milky Way galaxy itself is 100,000 [light years](#) in diameter, or 100 times the distance of this cosmic event from the cradle of Earth. "If a comparable event happened today at a similar distance from the Solar System, the ensuing radiation could outshine the entire night sky," Marka said.

The researchers believe that their study provides insight into a uniquely consequential event in our history. "It sheds [bright light](#) on the processes involved in the origin and composition of our [solar system](#), and will initiate a new type of quest within disciplines, such as chemistry, biology and geology, to solve the cosmic puzzle," Bartos said.

"Our results address a fundamental quest of humanity: Where did we come from and where are we going? It is very difficult to describe the tremendous emotions we felt when realized what we had found and what it means for the future as we search for an explanation of our place in the universe, " Marka said.

More information: Imre Bartos et al, A nearby neutron-star merger explains the actinide abundances in the early Solar System, *Nature* (2019). [DOI: 10.1038/s41586-019-1113-7](https://doi.org/10.1038/s41586-019-1113-7)

Provided by Columbia University

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