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Magnetic fields around the Milky Way could shed new light on the big bang
NASA/SOFIA; Star field image: NASA/Hubble Space Telescope

Astronomers are on the hunt for magnetic fields in our galaxy that were born in the very early universe, because they could provide a new way to study the big bang.

"We're not solving the puzzle of these fields but we're kind of opening that door," says Sergio Martin-Alvarez at the University of Cambridge.

Magnetic fields are thought to play an important role in star formation within galaxies, and the Milky Way is home to various types of field. Some come from stellar explosions, others from black holes, while some, known as primordial magnetic fields, are believed to come from a period of rapid cosmic inflation thought to have occurred fractions of a second after the big bang.

We have never been able to tease these ancient fields apart from the others, but Martin-Alvarez and his colleagues say they have found a way to do so. The team modelled the evolution of recent and primordial magnetic fields in the Milky Way. The group found that primordial magnetic fields seemed to always survive throughout time and could currently be far stronger than previously thought.

"I was so surprised that they survived," says Martin-Alvarez. "Now we need to look for the things that telescopes can actually measure."

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The primordial magnetic fields seem to be distributed more towards the centre of the galaxy, while those that come from stars and black holes are more evenly distributed. The team hopes soon to calculate what astronomers will need to look out for to distinguish these ancient fields.

That could have big implications. If you can measure primordial magnetic fields in one galaxy, you could potentially measure the primordial magnetic field of the entire universe, says Martin-Alvarez. "This is something that we did not think would ever be possible."

This study makes a case for being able to distinguish whether galactic magnetic fields have a recent astrophysical origin, from a black hole for example, or a primordial, cosmological origin, says Tanmay Vachaspati at the University of Arizona. "If future observations point to a cosmological origin, it will have implications for particle physics and our understanding of the early universe."

"If we find primordial magnetic fields, they offer a new window on the big bang cosmology, because it would take some unusual event to produce them in the early universe," says Alexander Kusenko at the University of California, Los Angeles.

Reference: arxiv.org/abs/2011.11648v1

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