Scientists Discover New Nature Of Dark Matter

Computer simulations show new insights into the nature of dark matter, particularly with axions, those particles associated most with the mysterious invisible matter that makes up over 80 percent of the Universe.
(Photo : ESA, NASA)

Although we have an idea of how much dark matter exists in the Universe, we still don't know exactly what it is.

However, scientists at the University of Granada recently made new strides in understanding dark matter and discovered new details about axions, possible components of dark matter.

Dark matter is all around us and makes up more than 80 percent of the Universe. However, we only know this thanks to its gravitational effects on visible matter. It's impossible to see, having never been directly detected, which makes it one of the biggest mysteries in astrophysics.

However, many astrophysicists theorize that dark matter is actually made up of something called axions, and the Granada team, along with other scientists all over the world, believe they've discovered new information about those hypothetical particles.

These scientists used computer modeling instead of particle accelerators, though, with their virtual laboratories being stars. The heat inside a star converts photons into axions, which eventually escape into space, taking all their energy with them.

"This loss of energy can have consequences, whether they are observable or not, in some phases of stellar evolution," says Adrián Ayala, member of Granada's FQM Stellar Evolution and Nucleosynthesis research group. "In our research, we have conducted numerical simulations (by computer) of the evolution of a star, since its birth until it exhausts all the hydrogen first and then the helium in its interior, including the processes that produce axions."

These computer simulations show that the escape of axioms speeds up the combustion of helium inside stars, which means that the star consumes helium faster. This is called the Horizontal Branch (HB) phase, which happens when nuclear combustion replaces the energy in the star after it loses the energy of the axions that escape.

"Using this influence over the timing that features in this sort of evolution we can determine the emission of axions, since a high emission rate means a quick HB phase, thus diminishing the possibility of watching stars in this phase," says Ayala's Ph.D. supervisor, Immaculada Domínguez.

Basically speaking, we can look for axions, and in turn, possible evidence of dark matter, by studying how fast stars use up their helium.

Of course, this work is still highly theoretical because there's no current way of determining that the calculation of the original amount of helium in a star is correct. However, the simulation and resulting study does present a new branch of science, bringing together astrophysics and particle physics, "astroparticle physics."

Photo: ESA, NASA