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Astrophysics

Milky Way's gamma-ray glow could be from pulsars

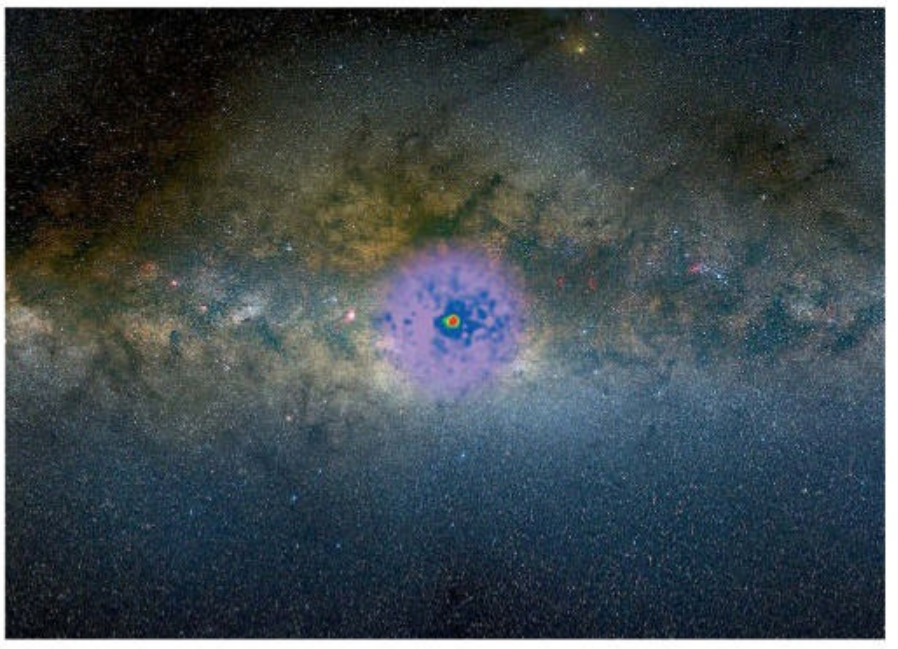
Will Gater

A MYSTERIOUS gamma-ray glow in the inner parts of our galaxy could be due to thousands of dead stars spinning at hundreds of times a second. These millisecond pulsars are formed from the remnants of stars that have used up all their fuel, but now blast out radiation. A similar thing might also be happening in the nearby Andromeda galaxy.

The enigmatic glow, called the Galactic Centre Excess (GCE), was first identified in 2009. Since then, several ideas have emerged to describe how it might be formed. One hypothesis posits that the radiation is created when dark matter particles meet and annihilate, releasing gamma-ray light, while another points the finger at millisecond pulsars. In the latter case, astronomers had largely been focusing on millisecond pulsars whose origins lie in binary star systems where one star has experienced a violent supernova explosion.

Now, Roland Crocker at the Australian National University, Canberra, and his colleagues have suggested that another type of millisecond pulsar – those formed when a massive white dwarf rips material from a star before collapsing and transforming into a whirling pulsar – can produce a characteristic gamma-ray light that tallies with what astronomers see coming from the Milky Way's centre (*Nature Astronomy*, doi.org/hr4d).

While that on its own doesn't rule out dark matter annihilation as a possible source of the GCE, it does present an alternative phenomenon that can "explain the entirety of the signal", says Crocker. "My own view is that the best interpretation now is that not only is the GCE astrophysical rather than dark matter in origin, we know the specific astrophysical sources responsible for it," he says.



NASA GODDARD; A. MELLINGER, CMU; T. LINDEN, UNIV. OF CHICAGO

The Fermi Gamma-ray Space Telescope's view of the galactic centre

This finding is complemented by a separate study looking at a gamma-ray glow coming from the nearby Andromeda galaxy. Fabian Zimmer at the Gravitation AstroParticle Physics Amsterdam Centre in the Netherlands and his colleagues created maps of where old stars are located within the galaxy, using these as an indicator for where millisecond pulsars are expected to exist.

Adding this information to their model of gamma-ray production revealed that the potential contribution from the pulsars was enough to account for the level of gamma rays seen emanating from Andromeda (arxiv.org/abs/2204.00636).

"In other words, there was no more 'room' for the dark matter, as almost all of the excess was already explained by the other components used in our study," says Zimmer.

Crocker believes future research will show that the glow from Andromeda is caused by the same type of millisecond pulsars that his team suggests causes the GCE. "It's entirely reasonable and, indeed, consistent with the evidence that both excesses share a similar origin," he says.

Jeff Grube at King's College London says the Cherenkov Telescope Array (CTA) project being built in Chile and the Canary Islands will observe the inner Milky Way to investigate the GCE further.

CTA should also be able to help study Andromeda by looking for as-yet-undetected higher-energy gamma rays coming from any millisecond pulsars, says Alison Mitchell at the Erlangen Centre for Astroparticle Physics in Germany. "If [the higher energies are] not detected, this can constrain the hypothesis that millisecond pulsars are responsible for the emission." ▮

Space flight

Test dummies gauge radiation risk for female astronauts

Alex Wilkins

IT'S one small step for a mannequin, one giant leap for womankind. Mannequins designed to represent female bodies will be sent into space for the first time later this year to study how radiation affects women in space.

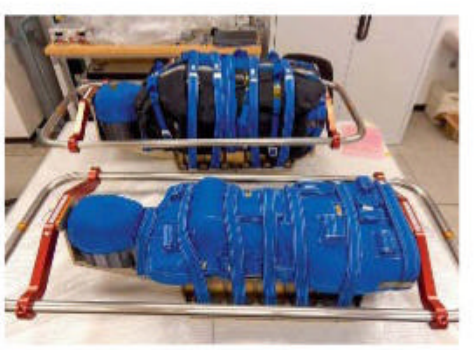
NASA aims to send the first female astronaut to the moon as part of its planned series of Artemis space flights. The first mission, Artemis 1, will be an uncrewed test flight of the Orion spacecraft, which will head beyond the moon and back to Earth over four to six weeks.

Powerful radiation is abundant in space, but all previous studies of its effects on the human body have been on mannequins with a male form. But organs such as breasts and ovaries are particularly sensitive to radiation, putting women at a greater risk of cancer caused by radiation than men.

Thomas Berger at the German Aerospace Center in Cologne and his colleagues have designed a pair of mannequins to mimic female torsos and the organs within that will fly on the Artemis 1 mission. Named Helga and Zohar, each contains 5600 passive radiation sensors. Zohar will wear a radiation-blocking vest, whereas Helga will be vestless.

"You [will] get baseline data from the radiation load a human female would receive while flying in a spacecraft which is actually built for humans," says Berger. ▮

Mannequins named Helga and Zohar are designed to replicate female anatomy



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