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Space

Black hole telescope launched

The Imaging X-ray Polarimetry Explorer will probe the universe's most exotic objects

Will Gater

NASA and the Italian Space Agency have launched an X-ray-observing mission that will give astronomers an important new tool for studying energetic objects across the universe.

The Imaging X-ray Polarimetry Explorer (IXPE) rode into orbit on a SpaceX Falcon 9 rocket from Cape Canaveral, Florida, on 9 December. It will measure the polarisation of X-ray light coming from objects including neutron stars, black holes and the glowing leftovers of exploded stars, known as supernovae remnants.

Polarisation can be thought of as a collective orientation of the electromagnetic waves that make up light. Studying this aspect of the X-ray glow from astronomical bodies can help researchers refine their models of the physics at work in those objects.

"Each [theoretical] model of any of these [X-ray] sources has a peculiar expected signature in polarisation and measuring it would allow us to [identify] the correct model," explains Fabio Muleri at Italy's National Institute for Astrophysics, who works on the IXPE project.

Polarisation data can also provide clues about the physical characteristics of distant objects. For example, it can reveal if an X-ray-emitting object has an asymmetrical shape – such as a swirling disc of superheated material around a black hole or neutron star.

"Measurements of polarisation give us the opportunity to study the asymmetry of the system even when the source is too far, or too small, to be resolved with our telescopes," says Muleri.

The mission's targets for further study include the immense "relativistic" jets of matter blasted out from black holes at close to the speed of light. The IXPE observations should give researchers a detailed insight into the magnetic fields and particles within these jets, says Ziri Younsi at University College London.

"This information will be important in understanding the genesis and structural composition of relativistic jets, as well as helping to clarify more precisely how black holes power and launch these [jets] across such vast distances," he says.

Supernovae remnants are another type of object that IXPE will investigate. Astronomers think these glowing clouds of material – permeated by violent shock waves from the detonation of a star – are responsible for producing high-energy particles called cosmic rays.

"These are believed to be important to heating up gas in the cosmos," says Mikako Matsuura at Cardiff University in the UK. "Polarisation imaging in the X-ray wavelengths will capture exactly how the particles are accelerated in supernova remnants."

The prospect of starting to resolve enduring astrophysical mysteries is already generating excitement. "Over [the years], we accumulated many expectations based on our current knowledge that we now will be able to confirm or disprove," says Muleri. ▮

NASA

An artist's impression of the new IXPE space observatory in orbit

Child development

Mother's scent helps babies bond with strangers

BABIES are more socially receptive to unfamiliar women when they can smell their mother's natural body odour, suggesting that maternal scent functions as a safety signal.

Previous research has found that mothers' unique smell signatures allow their babies to recognise them and have a soothing effect when they are in pain. Yaara Endevelt-Shapira at The Interdisciplinary Center in Herzliya, Israel, and her colleagues wondered if signals in maternal odour also change the way infants respond to strangers.

They asked 62 mothers to wear cotton T-shirts for two consecutive nights and avoid using deodorant or other scented products, so that their natural smell would rub off onto the clothing. Their babies – aged 7 months on average – were then strapped into chairs and introduced to an unfamiliar woman who was about the same age as their mother, lived in the same area and was a mother herself.

When the babies had their mother's T-shirt under their nose, they were more likely to smile, laugh and gaze at the stranger than if they were sniffing an identical unworn T-shirt (*Science Advances*, doi.org/g8xm).

Electroencephalography (EEG) devices fitted to both participants' heads showed that the babies' brainwaves were also more likely to synchronise with the stranger's when they could smell their mother's T-shirt. The same kind of synchronisation is seen in babies and their mothers when they gaze at each other and is thought to be a sign of feeling mutual connection.

"Maternal body odours can assist infants in transitioning to social groups"

The findings suggest that "maternal body odours can assist infants in transitioning to social groups, exploring new environments and communicating with unfamiliar partners", says Endevelt-Shapira.

The researchers didn't look at whether the scent of fathers or other familiar caregivers can have a similar effect, but are currently investigating this. ▮

Alice Klein