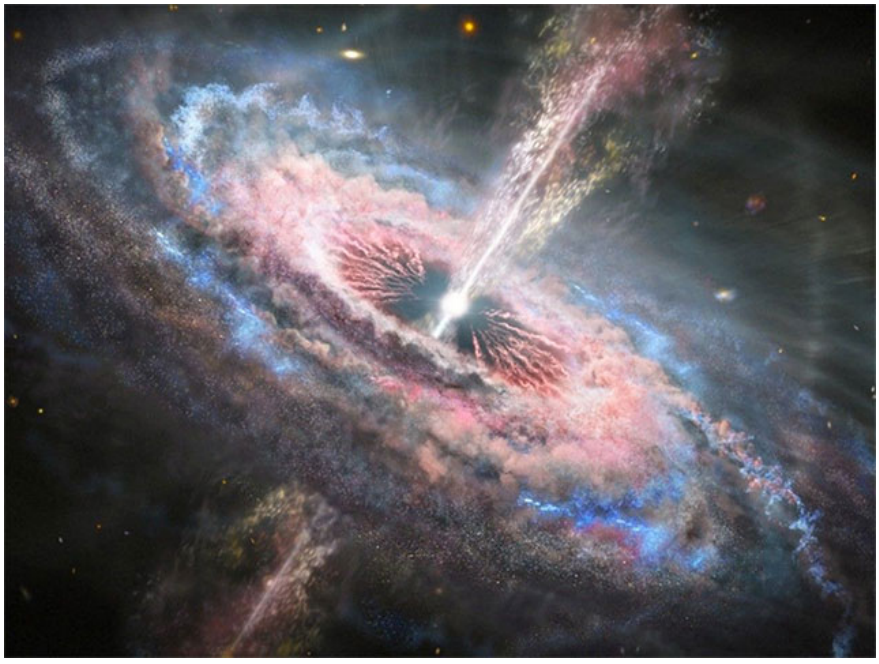
New NASA research makes black holes more mysterious than ever.

NASA has just detected unusually high levels of X-ray polarization from the black hole IGR J17091-3624, opening up new clues about how black holes work and the mechanisms by which the solar corona emits X-rays.

A team of astronomers using NASA's **Imaging X-ray Polarimetry Explorer (IXPE)** satellite has just discovered something that could change how we understand black holes. Observing the **IGR J17091-3624** star system , located about 28,000 light-years from Earth, they found that the X-rays emitted from this region are much more polarized than previously predicted.

Polarization is a property of light that indicates the direction of oscillation of the electric field. Measuring polarization helps scientists understand what is happening near black holes—where the extremely strong gravitational force distorts light in unpredictable ways. In March 2025, IXPE first detected X-ray polarization from the IGR system J17091-3624 in the energy range of 2–8 keV. The results showed a polarization of **9.1%** with very high statistical confidence, along with a polarization angle of approximately **83 degrees** . There was a slight indication that polarization increases with energy, but it was not yet certain enough to confirm this.



In this observation, the black hole is in a 'solid' state dominated by the corona—the superheated gas plasma surrounding the black hole that emits most of the X-rays. The energy spectrum obtained shows a solid power-law pattern with very few reflections, and also exhibits near-periodic oscillations (Type-C QPO) at a frequency of approximately 0.2 Hz.

' **The IGR J17091-3624 black hole is an incredibly unique source, fluctuating between bright and dim like a heartbeat, and IXPE has helped us observe it in a completely new way** ,' shared Melissa Ewing (Newcastle University). In systems like this, the black hole sucks matter from its companion star, forming a rotating disk of hot gas. The corona is located in the innermost region of the disk and can reach temperatures of up to **1.8 billion degrees Fahrenheit** , enough to produce extremely bright X-rays. Despite its brilliance, the corona is too small and too distant to be photographed directly.

Giorgio Matt (University of Roma Tre) said: " **Such high polarization is usually only seen when we observe the corona almost from the side. The shape of the corona must be very 'perfect' and the viewing angle must be perfectly correct to produce this value.** " He added that the strange 'flickering' pattern of this star system is still unexplained, and it may very well be key to better understanding similar black hole groups. Because the direction of the radio wave stream has not been determined, scientists cannot directly compare it to the X-ray polarization angle, but if it is similar to other systems studied, the two directions are usually parallel.

To explain the unusual polarization, the research team tried several hypotheses. One possibility is that matter is being blown out of the gas disk. As X-rays from the corona scatter in this wind, they can create the high polarization observed. Another hypothesis suggests that the plasma within the corona may be moving away from the black hole at speeds up to **20% the speed of light** , creating relativistic effects that increase polarization. Both scenarios are consistent with Comptonization, where the shape, viewing angle, and scattering medium all contribute to shaping the X-rays we receive.

" **These winds are a crucial missing piece in understanding how black holes grow** ," said Maxime Parra (Ehime University). He hopes future observations from IXPE will reveal even more surprises. Currently, the unusual polarization of IGR J17091-3624 is providing new clues about how black holes work and the mechanisms behind the coronal mass ejection.