X-Ray Polarization of the Reflection Spectrum With IXPE Data From Cygnus X-1

Amoils, Daniel (School: Columbia Grammar and Preparatory School)

The extreme nature and strong gravity of black holes make them a great laboratory for testing our fundamental theories of the universe. We can not see black holes because their gravity is so strong that no light can escape, meaning we need to use other methods to study them, such as observing the light from their accretion disks. One part of the black hole accretion disk system is known as the corona, which is a region with an unknown geometry. The lack of knowledge about this geometry limits our ability to learn more about black holes. Previous studies have used the polarization of light in order to narrow down the coronal geometry. These studies did not take into account the effect that light reflected off of the disk has on the polarization. The goal of this study is to see how taking that into account affects the previous results and their claims about the coronal geometry. I found that including this using a newly developed model called kynstokes leads to the same measurement of the polarization degree and angle. This supports the conclusion of earlier studies that the corona is extended horizontally. The alignment of the polarization angle with the jet angle also supports the connection between the jet and the innermost regions of the accretion disk. These findings about the corona can lead to more accurate models, allowing us to better study black holes and their properties, along with using them to test our theories of gravity.

Awards Won: