Galaxies rotate at such speeds and in such a way that ordinary matter alone—the stuff we see—would not be able to hold them together. The amount of mass that is "missing" visibly is dark matter, which is thought to make up some 27 percent of the total contents of the Universe, with dark energy and normal matter making up the rest. PGC 54493 has been studied in connection with an effect known as cosmic shearing. This is a weak gravitational lensing effect that creates tiny distortions in images of distant galaxies.

Even though we cannot observe dark matter directly, we know it exists. One prominent piece of evidence for the existence of this mysterious matter is known as the "galaxy rotation problem."