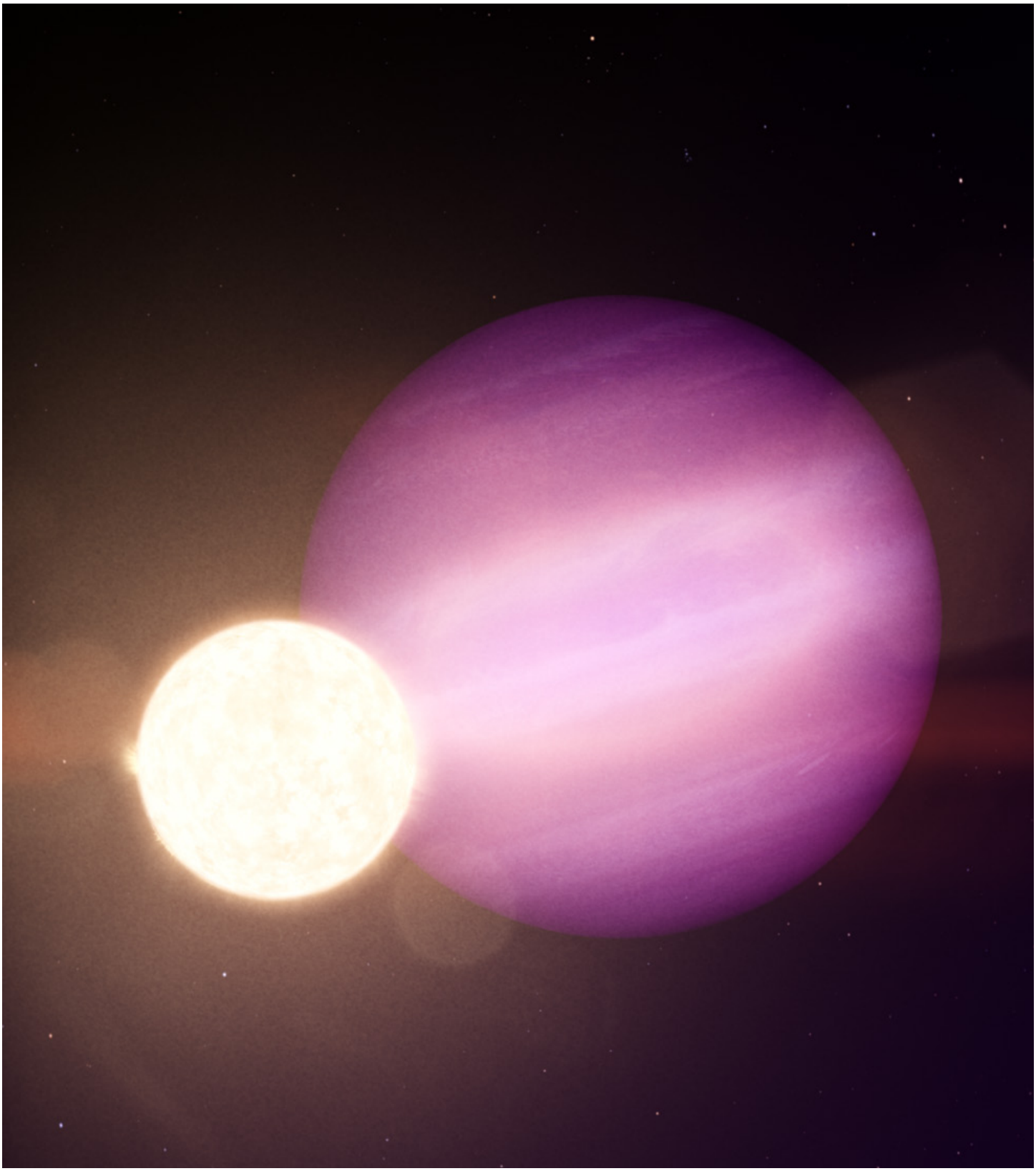
National Aeronautics and Space Administration



WD 1856 b: An illustration of the Jupiter-sized planet orbiting its smaller, denser white dwarf host star. Credits: NASA's Goddard Space Flight Center

# “I’m a Survivor”

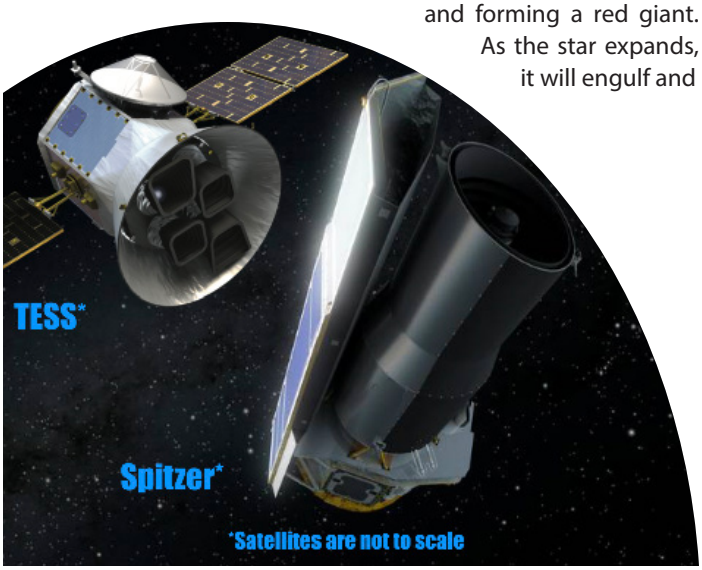
## A planet hugging a white dwarf

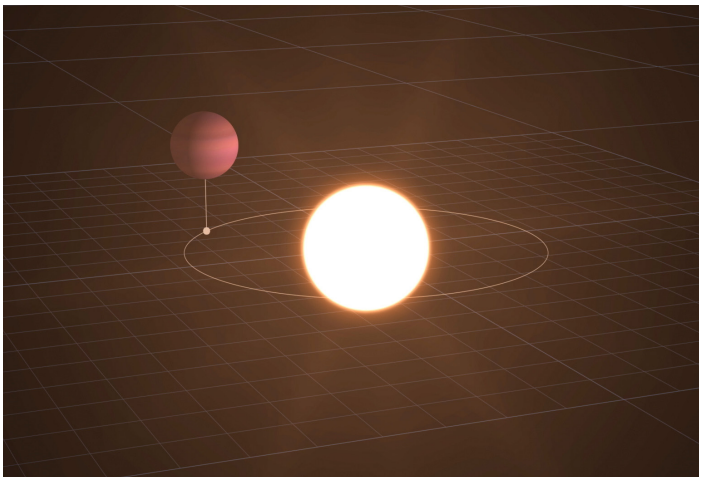
**NASA’s Transiting Exoplanet Survey Satellite (TESS)** is an explorer class mission designed to detect planets in our galaxy transiting their host stars. Data from this mission is often combined with that from other ground and space-based telescopes, enabling fascinating discoveries.

A team of astronomers, using data from TESS and the now-retired **Spitzer Space Telescope**, detected a Jupiter-sized planet that was closely orbiting a white dwarf star called WD 1856+534. This white dwarf is just ~11,000 miles across and about 10 billion years old.

The planet orbiting the white dwarf is known as WD 1856 b and is about seven times the size of its host, which is extremely unusual! At approximatly 14 times the size of Jupiter, WD 1856 b orbits the white dwarf every 34 hours, which is 60 times faster than Mercury around our own Sun. The system itself is approximately 80 light years away in the northern constellation of Draco.

Finding a planet around such a white dwarf is rare given the destructive events that occur during the stars formation. A white dwarf is the residual core of material that is left over when a star like our Sun reaches the end of its life. This core is hot and dense and will spend the rest of time cooling. When a star like our Sun runs out of hydrogen in its core, it will “fluff up”, expanding to about 1000 times its current size, cooling and forming a red giant. As the star expands, it will engulf and incinerate any closely orbiting planets in the system. Eventually, as the star ages and consumes more and more of its resources, the outer layers will be blown away, losing up to 80% of its mass, leaving behind a hot dense white dwarf core. It is almost impossible for a nearby planet to survive such an event.



Artist impressions of how the WD 1856 system may have evolved. Image credits: NASA/JPL-Caltech/NASA GSFC

Scientists suggest that in order for the planet to survive such a volatile process, it must have been originally located 50 times further away than its current orbit. The planet was then “nudged” closer to its host star. Possible mechanisms include:

- Other Jupiter-sized bodies close to WD 1856 b’s original orbit could have gravitationally knocked it inward.
- There are two other stars in the system - red dwarfs G229-20 A and B. These two stars, joined by another potential rogue star passing through the system, could have perturbed the orbit of the planet over a billion years, forcing it inward.

The second scenario listed above is less likely than the first.

Currently, there is no evidence suggesting that there are other worlds in this system. However, it is possible that they exist but have thus far evaded detection. These potential planets could have more distant orbits making detection with TESS difficult, or that they orbit in such a way that a transit does not occur.

This unique system has prompted further research into the study of other worlds that orbit white dwarf stars.