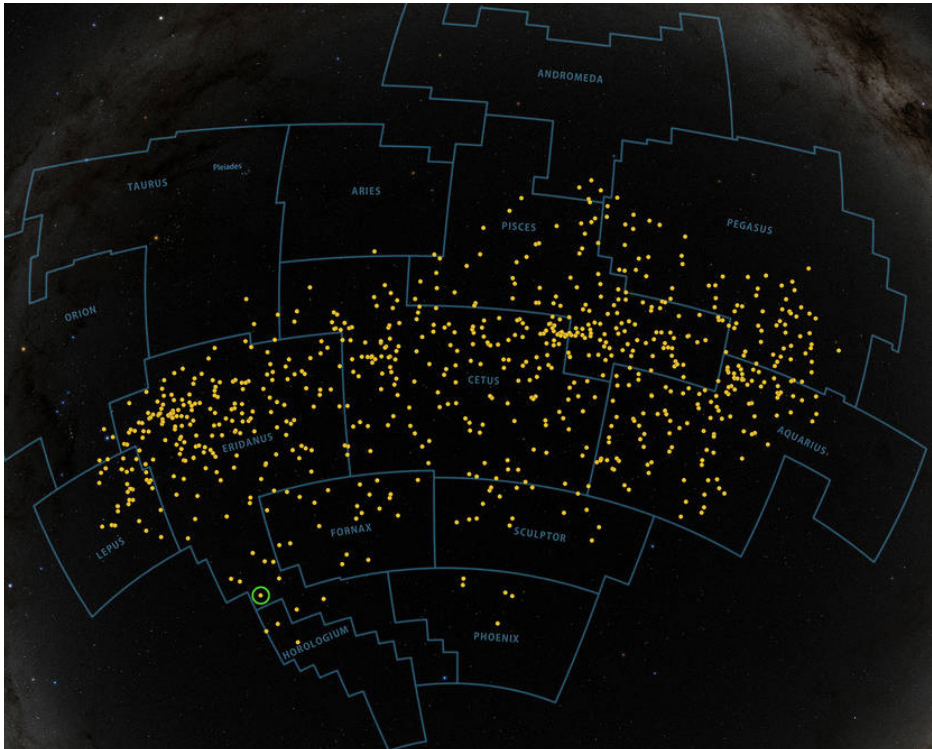


TOI 451: Illustration of the triple planetary system located 400 light-years away in the constellation of Eridanus. Credit: NASA's Goddard Space Flight Center

A River of Young Stars



The Pisces-Eridanus stream: This stream of stars spans 1,300 light-years, 14 different constellations, and approximately one third of the sky. Each yellow dot shows the location of known or suspected members of the stream. The planet host, TOI 451, is circled in green. Data from the TESS mission indicates that the stream is roughly 120 million years old. Image Credit: NASA Goddard Space Flight Center

A trio of hot worlds

NASA’s **Transiting Exoplanet Survey Satellite (TESS)** is an Explorer class mission designed to detect planets in our galaxy transiting their host stars.

In 2018, TESS detected the triple planetary system, TOI 451. The system is located in the Pisces-Eridanus stream of stars which is approximately 120 million years old, and 400 light-

away. The host star, TOI 451, is a G-type dwarf which is 95% the mass of the Sun, 12% smaller, slightly cooler, and emits 35% less energy. The star has a rotation period of 5.1 days.

All of the planets orbit the host star at distances less than that of Mercury from our Sun. These tight orbits make the planets very warm (ranging from 2,200 degrees Fahrenheit for the closest planet to 840 degrees Fahrenheit for the furthest), but despite these high temperatures, astronomers still think they have retained much of their atmospheres.

Key facts about the planets can be seen in the table below:

Planet Name	Orbital Period	Size (Earth size)	Mass (Earth mass)
TOI 451 b	1.9	1.9	Between 2 and 12
TOI 451 c	9.2	3	Between 3 and 16
TOI 451 d	16	4	Between 4 and 19

Utilizing data from several other facilities such as **NASA’s Spitzer Science Telescope**, the **Near-Earth Object Wide-Field Infrared Survey Explorer**, and several ground-based facilities, astronomers have also detected the presence of a debris disc around TOI 451, where rocky asteroid-like bodies collide, grind themselves into dust and form a dusty belt. While scientists do not know the extent of this disc yet, they envisage something similar to a diffuse ring of dust and rock centered as far from the host star as that of Jupiter from our Sun.

The TOI 451 system is also thought to be gravitationally bound to a close neighbor located 4,700 AU away. This neighbor might be a binary system containing two M-dwarf stars, each with a mass 45% that of the Sun, and emitting only 2% of its energy.

This system is especially interesting to scientists because it contains three planets between two and four times the size of the Earth, each of which could hold key information about how planetary atmospheres evolve.