

Extrasolar Planets: *Planets Around Other Stars*

Part 1: Doppler Exoplanets

Astrometry & Doppler Detection Methods:

The gravity of a star pulls on a planet; the planet must also pull on the star (“equal and opposite forces”).

So both the planet and star orbit around the center of mass of the system (the balance point). Thus the star “wobbles” in the sky.

The star's wobble motion can be detected two ways:

1. Astrometry:

Measures the position of the star on the sky. This is very challenging to do, but space missions are being built that can measure the reflex motion of the star (GAIA).

2. Doppler effect (“RV method”):

Measures the star’s radial velocity as it orbits, using the Doppler effect and spectral absorption lines.

Measuring the Doppler shift is hard, but it is being done....

with great success: over 600 planets have been found using this method (as of early 2017). It currently is the second best way to find planets (the transit method has found more planets).

Most planets found via the “RV Method” are Jovian (gas giant) type planets. This is because only the most massive planets have enough gravity to make its host star wobble.

The RV method gives the orbital period and the *minimum* mass of the planet. It is the minimum mass because we don't know the inclination of the planet's orbit, so we are only measuring part of the star's velocity with the Doppler effect.

The RV method tells about about the mass of the planet, but not its size (radius).

The first exoplanet discovered around a Sun-like star occurred in 1995; the planet is called “51 Pegasus b” or “51 Peg” for short. It orbits its star in only 4.2 days! This was totally unexpected by astronomers. It is a Jovian type planet. It orbits very close to its star, and therefore is very hot.

Planets like 51 Peg b are known as *Hot Jupiter* exoplanets.