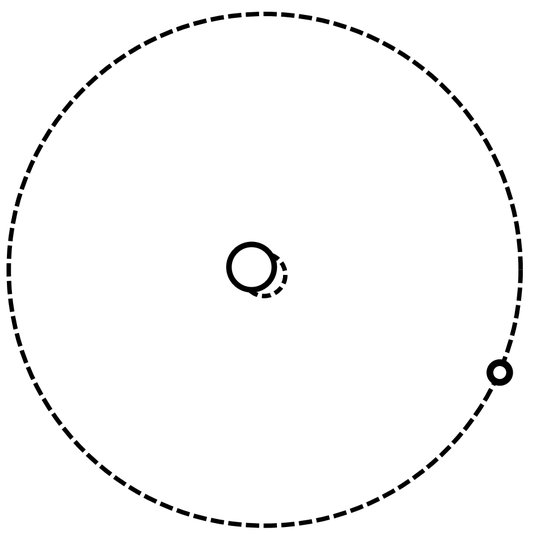
HIRES: Three Decades of Planet Hunting

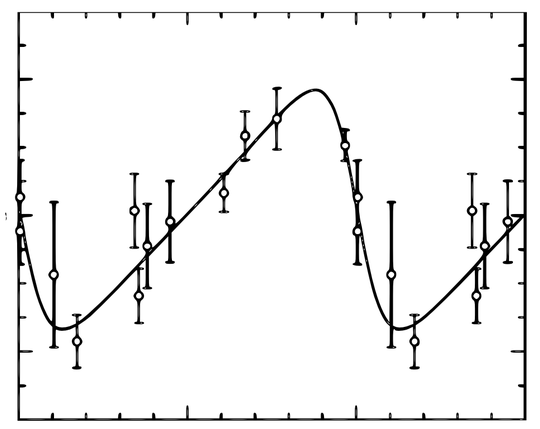
Among the many ways to hunt for exoplanets one of the most important is the radial velocity technique. This detection method takes advantage of the fact that, while a star pulls on a planet to keep it in its orbit, the planet also pulls on the star. One can imagine the star and planet both orbiting their common center-of-mass which is slightly offset from the center of the host star. While we cannot see the planet itself, we can infer its existence from watching the star wobble as it orbits the center-of-mass. Astronomers measure this wobble using a spectrograph which splits the starlight into its constituent colors (a spectrum) and also reveals dark gaps in the spectrum where light is being absorbed by different elements in the atmosphere of the star. These absorption lines always occur in very specific places in the spectrum but, as the star moves towards and away from us, the absorption lines will also move side-to-side in the spectrum through the Doppler effect. This is called the blueshifting or redshifting of absorption lines and by measuring how much these lines move, astronomers can work out how massive the planet orbiting the star is.

The High Resolution Echelle Spectrograph (HIRES) has been one of the most important instruments for detecting exoplanets with the radial velocity technique. In its nearly three decades of planet hunting, it has discovered over 150 exoplanets and has been essential for learning more about worlds discovered by other observatories such as Kepler and TESS. Included in its list of discoveries is GJ 436b, an exoplanet the size of Neptune orbiting a star 32 lightyears away.

This poster shows a planet orbiting its parent star. The hexagonal imprint on the star represents the 36 hexagonal mirrors which make up the Keck telescope that HIRES is connected to. The black line passing through the planet is part of a radial velocity curve. The height of the curve tells astronomers how massive an exoplanet is while the shape tells them about the shape of its orbit whether its circular or more like an oval (eccentric).



A planet and its parent star orbiting their common center of mass.



The radial velocity curve of a planet on a non-circular orbit.

Product of the University of Kansas ExoLab
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