Session 11 Minutes

Radial Velocity Method

There is a wobble created while both star and exoplanet revolve in their own orbits because of the gravitational pull they have on each other. We make use of the Doppler effect in this method.

We make use of the formula for the Doppler effect:

$$\frac{V_{\text{relative}}}{c} = \frac{\Delta\lambda}{\lambda}$$

And use the radial velocity vs time graph, which is generally a sinusoidal wave, to determine the time period.

$$p^2 = \frac{4\pi^2 a^3}{G(M_* + M_p)}$$

where p is the orbital period, a is the distance between the star and planet, and M_* and M_p are the mass of the star and planet, respectively.

$$v_r = v + k\sin(2\pi t + \phi)$$

$$k = \left(\frac{2\pi G^{1/3} p^{2/3}}{(4\pi^2)^{1/3}}\right) \frac{M_p \sin i}{(M_p + M_*)^{2/3}}$$

$$v_r = v \sin i$$

Anomaly is defined as the deviated angle of the planet from the semi-major axis joining the star and planet.

Factors to Take into Consideration While Searching for Habitability

- Temperature range: 273 to 373 K
- Pressure range: 0.6 to 2 atm
- Surface gravity: 0.8 to 1.2 g
- Planetary Mass: 0.5 to 5 Earth masses
- Eccentricity: 0 to 0.1

- Composition of atmosphere
- Magnetic field: 0.1 to 1 Gauss
- Chemical composition
- Heat flow: 0.04 to 0.1 W/m^2
- Plate movement speed: 1-10 cm/year
- Star: G to K type