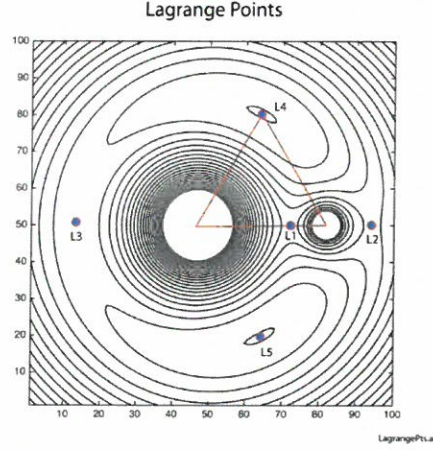
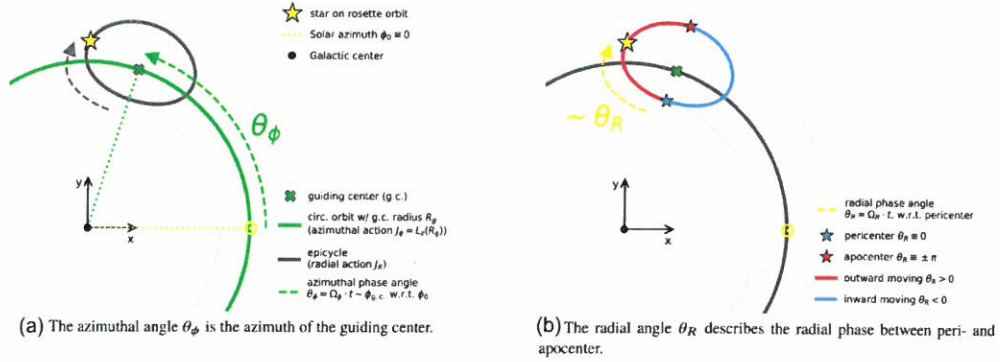


Qualifying Exam of Galactic Astrophysics (2024)

1. Why is the James Webb Space Telescope (JWST) placed at the Second Lagrange Point (L2)? (20%)



2. Please describe the 'Lindblad Resonance'. (20%)



3. Please derive the Jeans condition for a gaseous, self-gravitating system with finite temperature by linearizing the equations of hydrodynamics. Meanwhile you should explain the criteria of the gravitational stability/instability. (20%)

P.S. The hydrodynamical equations of a self-gravitating system,

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{v}) = 0, \quad \frac{\partial \vec{v}}{\partial t} + (\vec{v} \cdot \nabla) \vec{v} = -\nabla \varphi - \frac{1}{\rho} \nabla P$$

$$\nabla^2 \varphi = 4\pi G \rho$$

$$c_s^2 = \frac{\partial P}{\partial \rho}$$

4. Please derive the tensor virial theorem for a system of collision-less particles? (40%)