

Binary Stars

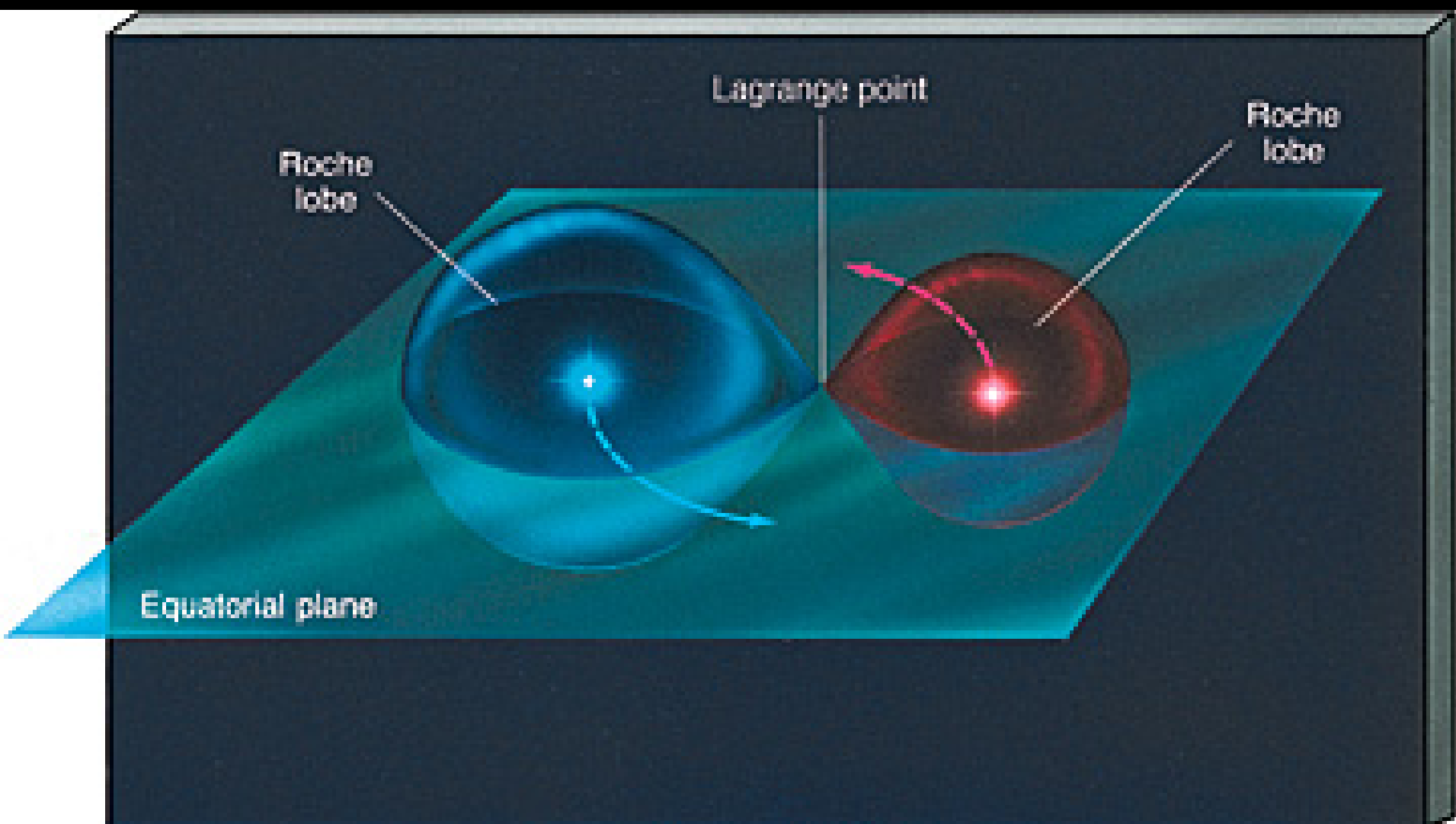
Solar systems with multiple stars!

How Common Are Binaries?

- Perhaps as many as 80% of the stars in our part of the galaxy are members of multiple star systems.
- Most of the multiple star systems contain only two stars, binary systems.
- Our Sun is uncommon not because of its structure or behavior, but because it has no other stellar companion.

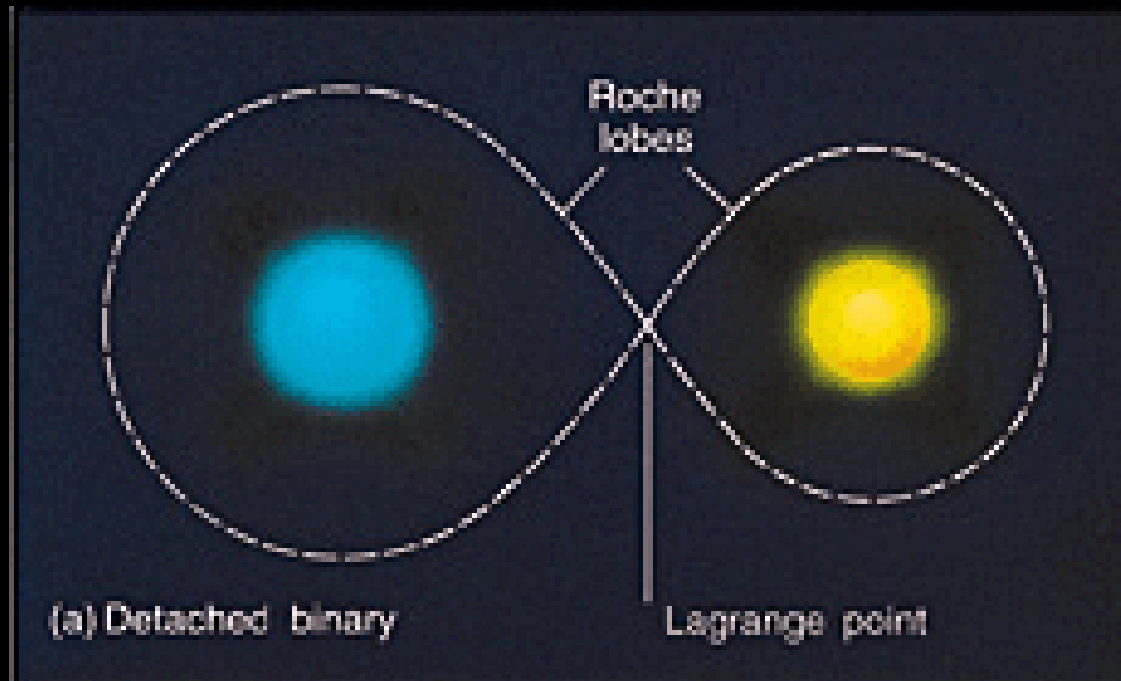
Roche Lobes and the L1 Point

- Roche lobes are imaginary bubbles that surround the each star of a binary system.
- These bubbles represent the area of gravitational dominance for each star.
- The L1 Lagrange point is where these two lobes meet and represents the point at which the gravitational pull from each star is equal in magnitude.



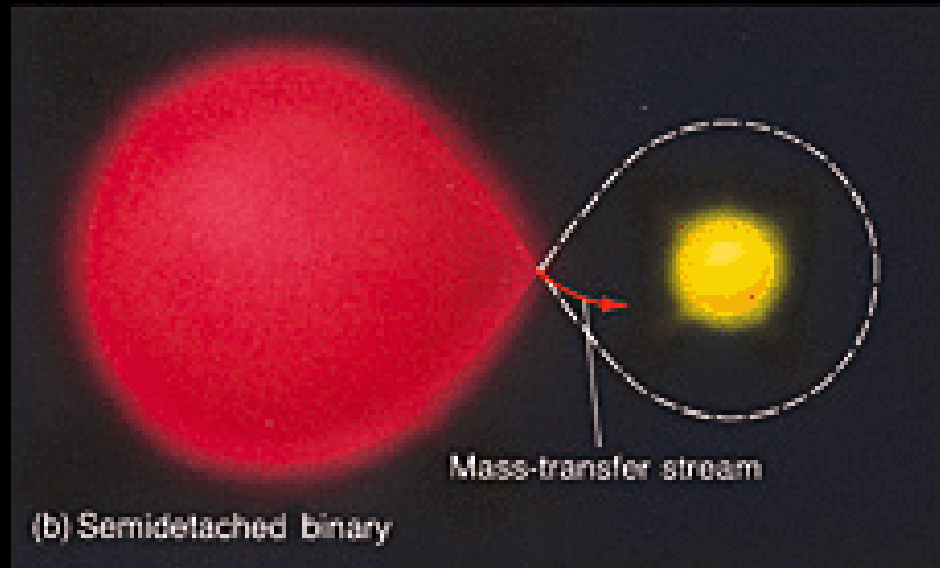
Detached Binaries

- The surfaces of the two stars are both within their respective Roche lobes.
- No mass transfer occurs in these binaries.



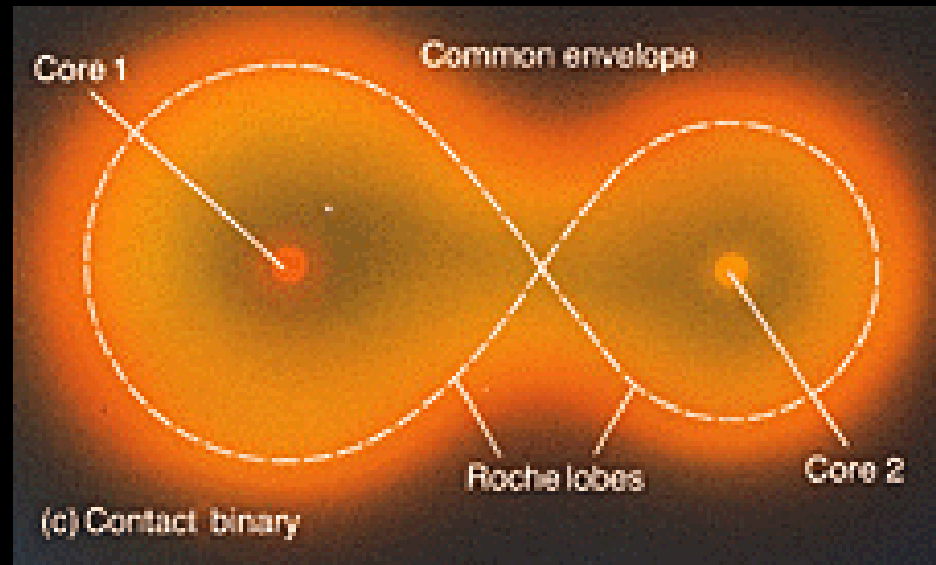
Semi-Detached Binaries

- One star has swelled beyond its Roche lobe while the other remains within its.
- Mass is transferred from the swollen star to the compact star.



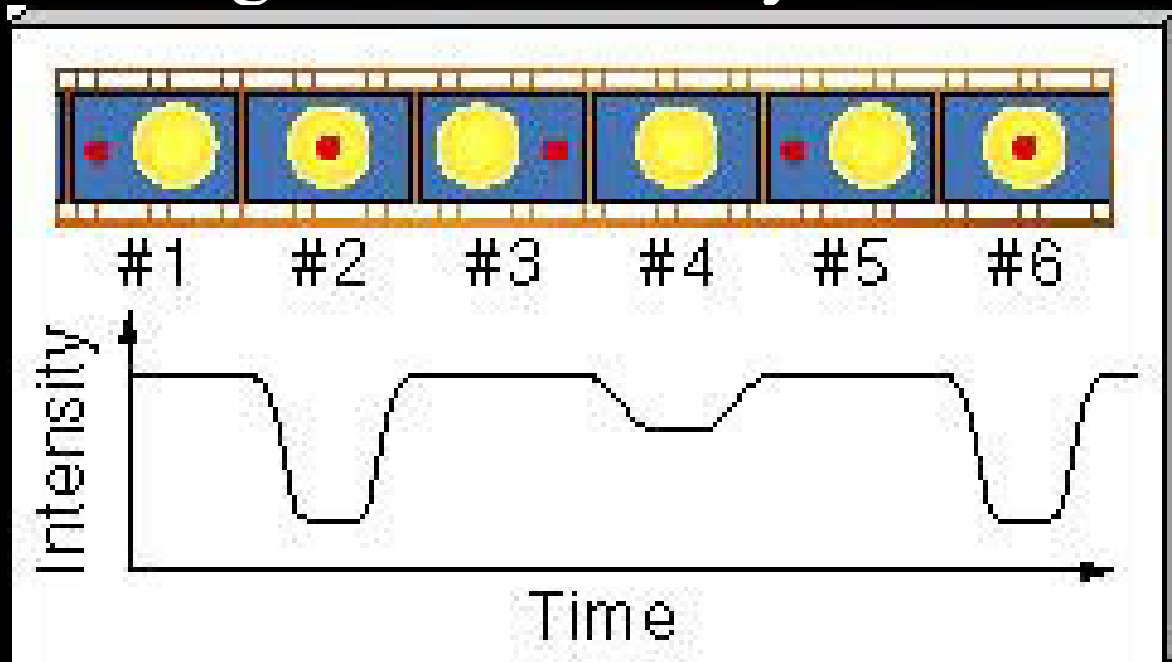
Contact Binaries

- Both stars have swollen beyond their Roche lobes.
- Mass is flows in two directions, but there is no net change of mass for either star. The system is in a state of dynamic equilibrium



Eclipsing Binaries

- When the orbital plane of a binary system aligns with our line-of-sight, we see an eclipse twice per orbital period of the binary.
- These eclipses can be seen in a *light curve*, a graph showing the brightness of the system as a function of time.



Cataclysmic Variables

- CVs are a special type of semi-detached binary formed by a white dwarf and another star, usually a red dwarf.
- Material drawn from the red star onto the white dwarf forms a disc around the white dwarf called an accretion disc.
- The hydrogen that accumulates at the center of the disc on the surface of the white dwarf can become superheated and ignite.
- This type of outburst is called a Dwarf Nova or a Recurrent Nova.