A theoretical S-type stable planetary orbit with period equal to the binary star period

by S Edgeworth 2001, 2012

The two stars have equal mass and their orbit has zero eccentricity. The planet orbits just one star (labelled “parent star”). The planetary orbit is retrograde, and coplanar. The orbital period of the planet is equal to the orbital period of the star system.

This theoretical orbit was obtained using n-body software. The orbit is stable. It does not depend on mean mutual resonance: in other words S-type orbits with periods slightly greater than 1, or slightly less than 1, are equally stable. (The orbit with period=1 is simply easier to illustrate as the orbit shape is closed).

The diagrams are in the inertial frame (not co-rotated). There is no motion in and out of the page. The planetary orbit and the stellar orbit are coplanar.

Diagram 1: shows the system when the planet is at its greatest distance from the other (non-parent) star

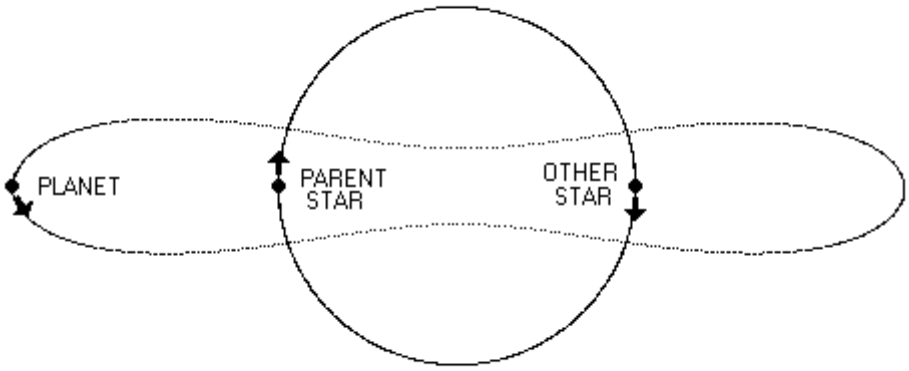
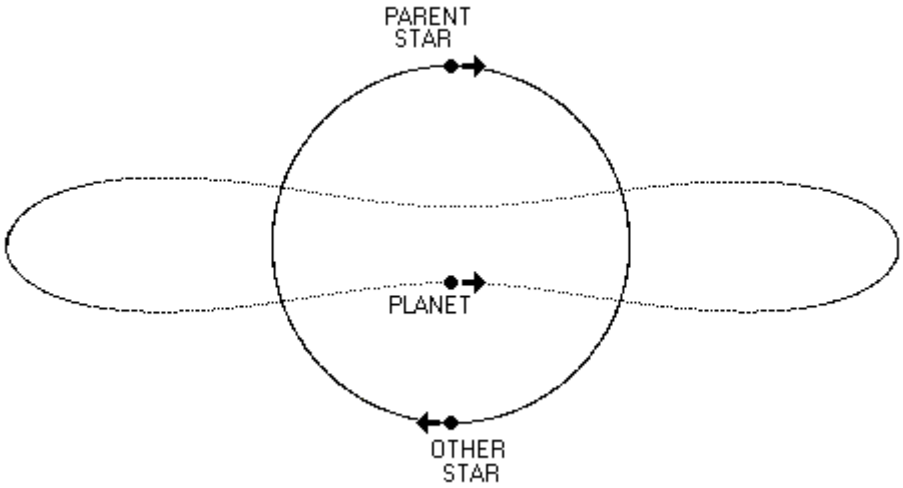


Diagram 2 shows the system a little later in the orbit, when the planet is at its closest approach to the other (non-parent) star



Initial parameters:

The starting parameters are given, so that researchers with the appropriate n-body software may reproduce the orbit:

```
[Body1]
Name= StarA (parent)
Mass= 0.5 SM
PosX= -0.5 AU
PosY= 0
PosZ= 0
VelX= 0
VelY= (0.5 * 2 * pi) AU/EY
VelZ= 0

[Body2]
Name= StarB (non-parent)
Mass= 0.5 SM
PosX= 0.5 AU
PosY= 0
PosZ= 0
VelX= 0
VelY= (-0.5 * 2 * pi) AU/EY
VelZ= 0
```

```
[Body3]
Name= Planet
Mass= 0
PosX= -1.2353 AU
PosY= 0
PosZ= 0
VelX= 0
VelY= (-0.324233194 * 2 * pi) AU/EY
VelZ=0
```

Abbreviations: SM = the mass of our sun. AU = astronomical unit. EY = earth year. pi = 3.14159...

References

www.orbsi.uk/space/simulator/simulator.htm?s=00036
An HTML5 simulation of this orbit.