CCK Special Topics Problem: Dyson Sphere
2007-Jul-13

In 1960, physicist Freeman Dyson theorized that an advanced civilization might build a rigid sphere enclosing a star, to capture all the energy from the star.

A. Suppose we built a Dyson sphere of radius 200 million km around our own Sun, which has luminosity $L_\odot = 3.8 \times 10^{26}\,\mathrm{W}$. Assuming that $L_\odot$ remains constant and that the outside surface of the sphere is a perfect absorber, what is the equilibrium temperature of the outside of the Dyson sphere?

B. In 1970, Larry Niven's novel Ringworld described a rigid ring built around a star. MIT students at the 1971 World Science Fiction Convention chanted, "The Ringworld is unstable!"

   i. What did they mean?

   ii. Does the rotation of the Ringworld affect its stability?

   iii. Does the same objection apply to the Dyson sphere?