

**Your Place in the Universe**

(a) We've learned a few solutions to Olbers' Paradox. Try to come up with two of your own, and provide reasons that might point to them being false. Be creative! (Examples: There's a "canceling" light for distant stars; stars are lined up on spokes away from us).

(b) Suppose that you want to communicate with extraterrestrials in another galaxy. How would Hubble's Law impact your communications?

(c) If Hubble's Law applies to all of space-time, why don't galaxies get ripped apart?

(d) What would it mean if the Hubble parameter were negative? What if it were a function of distance from the Earth?

**A galaxy far, far away...**

(a) Lucy is observing a distant galaxy. From its spectrum, she notices that the red H absorption line that typically occurs at 656 nm has been shifted to be at 787 nm. Use the Doppler shift formula to calculate redshift  $z$ .

(b) What recession speed will Lucy calculate?

(c) Lucy can now calculate the galaxy's distance using Hubble's Law,  $v = H_0 d$ ! What value will she arrive at?  $H_0$  is Hubble's constant ( $H_0 = 71 \text{ km/s/M pc}$ ). The distance value will have units of Mpc, or megaparsec.