Determining the Distance to the Whirlpool Galaxy (M51) using a Supernova Ia "Standard Candle"

Introduction:
In this activity you will use the measurements you have taken on the supernova in the images of M51 to determine the distance to the supernova and, consequently, to the galaxy M51. You will assume that the SN is a Type Ia and is, therefore, a standard candle. You will need to find some information about the reference star you used in the M51 images in order to "calibrate" the data you have taken.

Goal:
To determine the distance to the Whirlpool Galaxy in Light Years or Parsecs.

Procedure:
1. Remind yourself of what measurements and calculations you have already made and what information you already know:

a) the supernova's maximum brightness compared to the reference star in M51.
b) the supernova's luminosity, assuming it is Type Ia.
c) the relationship between Brightness, Luminosity and Distance, i.e. the Inverse Square law

2. In order to use the Inverse Square Law to calculate distance what other information do you need to know? What do you already know about these quantities?

3. If you were to know the Brightness in w/m^2 of the reference star in the M51 image, what else could you determine?

4. This particular reference star has been measured in recent sky surveys. See if you can find its actual brightness at http://simbad.u-strasbg.fr/sim-fid/. If you get discouraged come and see the instructor for this value.

5. Now see how you can use the information you have collected to calculate the distance to M51. Express your final value in LY and pc. You might find Mpc to be appropriate. Then you can also check on "Simbad" above to find out what the currently accepted distance is.

6. Your determination of the distance to M51 is not theoretical. It is based upon your own measurements and the measurements of others AND the assumption that the SN is a Type Ia. Your result will likely be "in the ball park" of what is currently known. On the other hand there are places where there could be error and/or uncertainty in your measurements and your work. **Where is there uncertainty in the measurements you have made?**