

Names:

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Grade	
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## Image Analysis

*With pointed fangs it sits in wait,  
With piercing force it doles out fate,  
O'er bloodless victims proclaiming its might,  
Eternally joining in a single bite.*

What is it?

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## Pre-Lab Quiz

Record your team's answers as well as your reasonings and explanations.

1.

2.

3.

4.

## Part 1: Measuring the Height of the Danforth Chapel

*labimage* → Terrestrial (R, G, B filters)

1. Under **Color** click **Combine Color** and determine the mixing ratio of your red, green, and blue filter images that produces the most realistic image and ***explain*** how you judged that the image looked "realistic".

**Note:** You can adjust the contrast using the screen stretch tool (ctrl+h).

Filter	R	G	B
Value			

2 What is the angular size ("height") of the chapel in pixels? Use the information window (ctrl + i) and set the mode to "area".

3. If the pixel scale of the image is 4' (arcminutes) / pixel, what is the angular size of the chapel in degrees? **Note:**  $1^\circ = 60' = 3600''$  (arcseconds).

4. Determine the height of the Danforth chapel in meters and feet if the photographer was 46 meters away. Show your work.

## Part 2: The Ring Nebula

*labimage* → *Nebula* → *Ring Nebula M57 (R, V, B filters)*

1. Make a tricolor image of the Ring Nebula. In the Combine Color window,

- For the green color, select the "V" filter image
- Click the *Align* option and set the align mode to *Auto – star matching*

The last part will align the stars, which are slightly offset from one image to the next.

Filter	R	G	B
Value			

2. Why are the inner and outer regions different colors?

3. What type of star is at the center of this planetary nebula and what is its surface temperature?

4. If the ring nebula is 2300 light years away, what is the radius of the nebula in light years? Show your work. **Note:** the pixel scale of the image is 0.73" / pixel.

## Part 3: Animating Images of the Asteroid 3 Juno

*labimage* → *Asteroid* → *3\_Juno*

1. Open all the images in one of the 3 Juno folders (105 or 106). Using the fits header (ctrl+f), determine on what date the images were taken.

2. Follow the directions below to make an animated image showing the asteroid's movement across the sky. Make sure only the asteroid images are opened.

- Under the tab **Process** click **Align**
  - ◆ In the *Select Images* window that appears, click *Add All* and then *OK*
  - ◆ In the *Align Images* window that appears, set the align mode to *Auto – star matching* and click *OK*
- Under the tab **View** click **Animate**
  - ◆ In the *Select Images* window that appears, add the images
  - ◆ In the *Animate* window that appears, click the play button

Have the TA mark below once complete and have identified the asteroid 3 Juno.

TA	
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3. The semi-major axis of 3 Juno's orbit is 2.67 AU. How long does it take to complete one orbit around the Sun? **Hint:** Think about Kepler's three laws.

## Part 4: Determining the Motion of Comet Garradd

*labimage* → *Comet*

Follow the directions below to stack the images.

- Under the tab **Process** click **Stack**
  - ◆ Select *Add Images* and add *garradd1.fts* and *garradd2.fts*
  - ◆ Click the *Align* tab and set the align mode to *Auto – star matching*
  - ◆ Click the *Combine* tab, set the *Combine Method* to *Sum*, then click "Go"

1. Why is it important to align the images?

2. What is the angular distance (in pixels) that the comet traveled from one image to the next? Record the horizontal ( $\Delta x$ ) and vertical ( $\Delta y$ ) shifts, as well as the total number of pixels traveled.

$\Delta x$	$\Delta y$	Total

3. If the comet was  $2.7 \times 10^{11}$  meters away when the image was taken, how far did the comet travel in km between the two images?

**Note:** The pixel scale for this image is 1" / pixel.

4. If the time between the two images is 1 hour and 8 minutes, what is the speed of the comet in km / s?

5. What assumption did you make when calculating the speed that might cause you to underestimate the true speed of the comet?

## Part 5: Observing the Night Sky

1. Find the following objects in the night sky and point them out to your TA.

Object	Type	TA
Arcturus	Star	
Big Dipper	Asterism	
Mizar-Alcor	Double Star	
Polaris	Star	
Summer Triangle	Asterism	

2. Find the following objects in the night sky and point them out to your TA.

Object	Type	TA
Altair	Star	
Deneb	Star	
Vega	Star	
Cassiopeia	Constellation	
Cygnus	Constellation	
Lyra	Constellation	