**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_**

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# UNIT 1: Activity 12 - Measuring Distance

# to the Moon by Parallax

**Purpose**

This activity is designed to provide you with a real-world experience of using parallax similar to how astronomers use it in their professional work. The objective, therefore, is not the correct result, but rather your decision-making in applying image processing, Small Angle equation, plate scale, parallax shift, parallax angle, and the Parallax Equation.

**Image**

The image you will use is a composite of three images of the Moon taken from three different locations on Earth at exactly the same time during a lunar eclipse on October 28, 2004. The map in the upper right corner shows the locations: A is Montreal, Canada; B is West Sussex, United Kingdom; and C is Montevideo, Uruguay. The Moon images are positioned as follows: A-lower left, B- lower right, and C-upper. The three original images were shifted and superimposed so that the background stars were aligned.

The Moon appears in three different positions against the background stars due to parallax. You can determine the distance to the moon using the parallax angle between any two of the Moon positions and the corresponding baseline. You need the following information:

* The plate scale of this image is 10.7 arcsecs/pixel ("/px)
* The straight-line distance (baseline) between A and B is 5076 km
* The straight-line distance (baseline) between A and C is 8360 km

**Procedure**

1. Launch SalsaJ, open the file Lunar Parallax 2004 and use Zoom tool to enlarge image. Adjust Brightness/Contrast for better viewing of the background stars.  
   *[In the following steps keep clear and complete notes on your data and calculations.]*
2. Use SalsaJ to measure the parallax shift (in pixels) between locations A and B (or between A and C). Because the images are superimposed, you can see and measure the parallax shift directly without using a reference star. Or you can choose a reference star and use the procedure you used with the magnolia tree in Activity 11.

Parallax shift:

1. Use the plate scale to convert this measurement to an angle, and the Parallax Equation to calculate the distance to the Moon in kilometers.

Parallax angle:

Parallax equation:

1. Compare you result with a published value of this distance; a reasonable value would be within about 10%. Keep in mind that the orbit of the Moon around the Earth is slightly elliptical, so its distance from Earth will vary over the course of a month or a year.
2. If you have time at the end you may want to follow the same procedure between the other two positions for which you have the baseline distance.