The Recording of the Path
of
Eris

Introduction. In recent years the question of the popular description of the "planets" of the solar system has been raises, discussed, and declared in the astronomical professions. The question revolved to a great extent about the transneptunian objects (TNO's). Of these Pluto and Eris were way out front. Early work on the discovery and observation of Eris indicated that it was larger and farther away than Pluto. This caused astronomers to raise the question, "where do we stop in naming planets?" That question has now been answered, at least temporarily, and does not impact the question, "what about them?"

I became involved in observing Pluto when a friend asked, "are we sure there is no ring structure?" I became involved in observing Eris when a possible occultation of a faint star was announced. While my observation of the occultation was a miss to the north, 2 other observers did find an occultation and the physical size was more clearly estimated for the first time. This tipped me to begin tracking Eris with the hope of finding its path accurately and watching for other potential occultations.

This note includes my early work in determining for myself the path of Eris. My hope is that, if a potential occultation exists, the data precision will be sufficient to make the prediction real.

Instrumentation. The occultation attempt was made using the 14-inch Celestron telescope and the Andor Luca camera with an exposure time of 2 seconds in a continuous mode with 1000 frames separated by less than 100 microseconds. The data review was performed visually and found to be negative. That is, there was no dimming of the candidate star.

Higher sensitivity images were taken using the 14-inch Celestron telescope equipped with an SBIG ST-8 camera fitted with AO-8 adaptive optics. The AO-8 provided high speed correction for minor tracking and atmospheric effects which would usually smear the images by several arcseconds. CCDOPS exposure times were normally 300 seconds and tracking was 0.1 to 0.2 seconds. Typically 5 to 10 images were recorded in an evening. Each image was dark subtracted, flat fielded, and aligned with the other images.

The average of all the aligned images was then resolved using CCDSOFT world grid system(WGS) astrometry. This yielded a highly resolved image of the mag 18.5 asteroid. The plate factor was 0.95 arcseconds per pixel and the FWHM was typically 2 pixels.

Occultation Results. Our observation established a northern limit to the shadow. An observation made in Chile was reported at 37 seconds and a second observation reported in Brazil was reported as 76 seconds. The fitting of a circle through these 2 measurements yields a diameter of Eris equal to or a little less than that of Pluto, thereby deepening the mystery of the character of Eris. The result, if confirmed would characterize Eris as having very high density and very high albedo.

Position Results. The position images were obtained as Eris moved through its western extension, an apparent reversal in location in the sky as the earth rotates about the sun. The locations in RA and DEC were converted from hours, minutes, and seconds to degrees in both values for the convenience of graphing. Figure 1 shows the path in RA and Figure 2 shows the path in DEC.

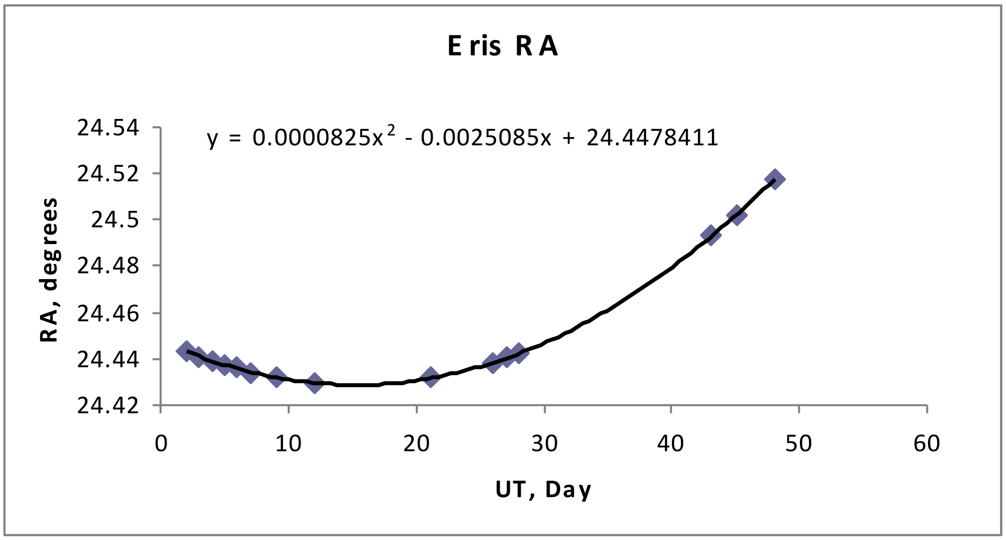

Figure 1. Path of Eris in RA in early 2011.

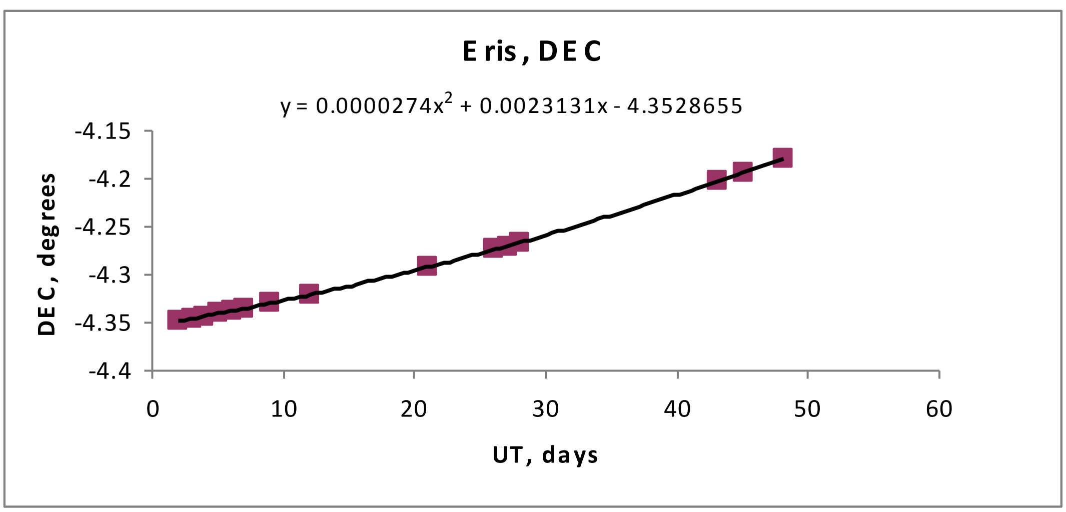

Figure 2. Path of Eris in DEC in early 2011.

A fit to second order equations is shown pasted into each graph. These fitted values provide for convenient determination of residual errors. The averages of the residuals are:

RA average residual	=	0.089084	arcseconds
DEC average residual	=	-0.127871	

The randomness on the residuals is:

RA one std deviation	=	0.757	arc seconds
DEC one std deviation	=	1.057	

The residuals are likely limited by the accuracy to which the standard stars is known.

The future. In the summer, perhaps about June 1, Eris will be visible clearly in the early hours. At that time we should be able to document its position at the eastward extension. This will provide broadly based data for interpolation and extrapolation of its positions. We shall continue, using this data and other that is available to find its size and shape by occultation.