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The December 10 Lunar Eclipse

by Robert H. Hays, Jr.

I had a good view of the December 10 lunar eclipse at its beginning. The local weather outlooks was good, but I decided to drive west for a longer view before sunset. I ended up watching the event from Iowa Falls, Iowa, where I had an excellent western horizon. Most of my visual observing was done with an 80mm refractor at 38x; I also used 10x50 binoculars. At 11h UT, 5 a.m., it was clear with a temperature of 7 degrees F. All timings are given in UT. A radio airing WWV was on continuously.

The penumbral shading was first definitely noticed at 12:10 with the refractor. It was a gray, steadily increasing shading until 12:40 when a brownish tint was noticed. I timed first umbral contact at 12:45:25. I was listening to the radio while the limb darkened substantially. (The timing is plus or minus 10 sec.} I also recorded three crater entrances early in the eclipse. I would watch the umbra's edge pass over the crater while listening to WWV and not the times. The moon was still high enough for the umbra's edge to be fairly well defined. These timings are shown on the accompanying sheet with a sketch. The timing of Riccioli refers to the dark spot on its floor. The timing of Grimaldi is the mean of opposite-side timings.

At 13:00, the portion inside the umbra was a uniform rusty red-brown color with a very narrow gray edge. Aristarchus was still visible. The umbral segment was easily seen with the binoculars though the moon was hardly a quarter of the way into the umbra at that time. Aristarchus faded out at 13:08, but the color of the umbra was still noticeable. The umbra's visibility at that altitude (about 4 degrees) probably meant a relatively bright totality later.

My view was clear up to that time, though the seeing was mediocre to fair. By 13:00, the seeing was poor, with air currents sweeping across the moon from south to north at the worst times. My view was cut off at 13:13 when the moon slipped behind some clouds that had quickly appeared in the west. I probably could have watched the eclipse for another ten minutes at my site. Those clouds overspread most of the sky in half an hour with the sun rising in the last bit of clear sky until later that day.

TIMINGS MADE NEAR START OF LUNAR ECLIPSE

DECEMBER 10, 2011 (UT TIMES)

CONTACT I ------- 12:45:25

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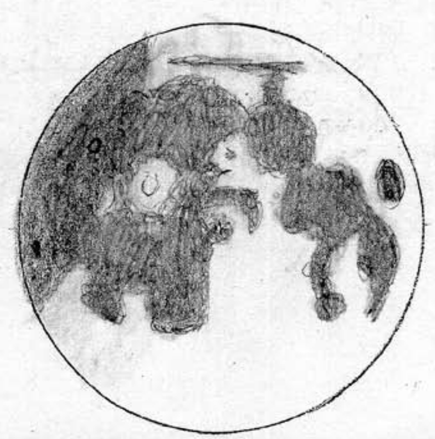
CRATER ENTRANCES

RICCIOLI -------- 12:49:55

GRIMALDI -------- 12:51:50

ARISTARCHUS ----- 12:54:25



13:00 UT

Robert H. Hays, Jr.

GRAIL

by Talon Brown

(It is very frustrating, attempting to piece together exactly what a spacecraft will do and how it will perform this task. Press releases aimed at the general public are too generalized for a full explanation and detailed explanations of data collected and methods involved are reserved, often for years, for researchers involved in the mission and people who can afford subscriptions to journals. This description was pieced together from a number of press releases listed below.)

The GRAIL spacecraft are currently in a near-polar elliptical orbit, circling every 2 hours. Beginning in March, the two satellites will send back radio signals so that scientists can begin to map lunar sub-surface features which will show any irregularities proving whether some areas are older than others. The mission should also shed light on the far side of the moon by gravity mapping, which is possible due to the fact that there are two orbiters communicating with each other. Gravity mapping requires careful tracking of changes in trajectory of an orbiting satellite. The lunar nearside has been mapped through Earth-based tracking of orbiters, but the farside has remained undone—there was no way for Earth-based tracking of satellites crossing out of our sight. The GRAIL spacecraft has two separate components which can track each other when crossing the farside. Sending the compiled data back to Earth will provide full lunar gravity maps. Gravity maps reveal significant data about subsurface planetary features and should show whether the moon is actually a formation of two moons that collided since, if the moon was a product of two moons, the crust on one side would be considerably thicker than on the other.

The telecom subsystem includes 2 S-band antennas to communicate with Earth, 2 X-band (8-12GHz) beacon antennas for Doppler LIDAR ranging measurements, done by sending LIDAR signals at the surface of the moon and measuring the time it takes for them to be bounced back against the speed of the LIDAR to find the distance the satellite is from the surface. In this way, small variations in the orbit of the GRAIL spacecraft can be tracked even on the farside. The craft communicate using an S-band (2-4 GHz) time transfer system antenna, which sends a time synchronization code back and forth between the spacecraft and a Ka-band (26.5-40GHz) ranging antenna for precision distance measurements between the spacecraft and Earth. All of these wavelengths are microwaves. The GRAIL satellites also each