LUNAR IMPACT OBSERVING

University of North Alabama
SPS Chapter # 4815
Box 5065
Florence, AL 35632

Students Interested: Christian Bayens, Matthew Cooper, Tiffany Davis, Koko Himeno, Maisey Hunter, Chase Johnson, Caleb Lane, Matthew Morgan

Principal Proposer:

Matthew Morgan

Advisor:

Dr. Mel Blake

Amount Requested: $ 1090

Date of Submission: 15 Nov 2013

The members of University of North Alabama's (UNA) Chapter of Society of Physics will use video camera recordings to observe meteor impacts on the lunar surface. This will in part support NASA's LADEE mission which will be studying the lunar environment and the Lunar Impact Monitoring Program.

The students are looking forward to becoming involved in National Aeronautics and Space Administration's (NASA) Lunar Impact Monitoring Program. NASA uses the data of the impacts to help define the meteoroid environment. Also as an added bonus, NASA also just launched the Lunar Atmosphere and Dust Environment Explorer (LADEE) with equipment to better understand the Lunar atmosphere using the dust kicked up from the impacts. Obtaining the equipment required to be involved with lunar observations will allow students at UNA to be involved with not only the ongoing Lunar Impact Monitoring Program, but future missions similar to LADEE as well. The research will help NASA and in turn, the world better understand the lunar environment and similar planetary bodies.

When the meteor impacts the moon, the energy release causes a flash of light bright enough to be visible from the Earth. The UNA observatory will serve as the main location for conducting the research. UNA's planetarium houses a Celestron 0.36m telescope which will be used for the observations. The 0.36m telescope is mounted on a Losmandy Titan equatorial mount. The observatory will be available to the project for approximately six nights a week, excluding the weekly public nights. The software for detecting the impact flashes is free. However, a Charge-Coupled Device (CCD) camera, a focal reducer, GPS time stamper, and a video digitizer are needed to record the data. The planetarium does not possess any of these items sufficient enough to meet the requirements for the observations. Since the flashes only last a fraction of a second, the system must maintain a video rate throughput of at least 1/30 second exposures to catch the explosions that only last for 1 or 2 of these frames which is beyond the capabilities of the planetarium's current CCD camera. The focal reducer allows for a bigger field of view, so more of the dark area of the moon can be observed. The GPS time signal is printed on the video for an accurate time reference making it easy to corroborate data with other observers. The video

digitizer converts the video into a digital signal, so it can be saved on the computer's hard drive. If a flash is observed the data can be reduced and sent to NASA for review.

Once the items are obtained and set up, observations can commence. SPS members will split the into groups to cover as much of the restricted viewing time as possible depending on individual schedules and weather over the rest of the year. The optimal time to observe is when the moon's surface is anywhere from 10-50% covered by sunlight and is further hindered by moonrise, moonset and twilight. NASA keeps a chart of these times on their website. (see figure 1)

Month	Evening	N.Twilight	Moonset	Phase
Dec	5/6		7:52	0.13
Dec	6/7	17:34	9:00	0.22
Dec	7/8		10:07	0.32
Dec	8/9		11:12	0.43

Month	Morning	Moonrise	N. Twilight	Phase
Dec	25/26	12:30		0.42
Dec	26/27	1:31		0.31
Dec	27/28	2:34	5:53	0.22
Dec	28/29	3:39		0.13

Figure 1: Lunar viewing times for Dec 2013 pulled directly from NASA's website.

The data that will be obtained at the telescope will be video frames of the dark part of the lunar surface. These frames will then be run through software supplied by NASA that searches for short-lived brightness increases. These are flagged by the software and the the data will then be supplied to NASA as video frames for calculation of a light curve (plot of brightness versus time) of the event. This will enable calculation of the amount of lunar material that might have been thrown up by the event. We expect several events a month to be observed, particularly during meteor

showers. Once an observation is scheduled and an impact is observed. The video is reduced and sent to NASA, where it is hopefully corroborated by other observers. The data can then be used.

Dr. Mel Blake will act as the supervisor for this project. He will train the students on the telescope and provide workstations at the observatory for the data reductions. He will also help obtain funding for students to present this work at conferences. He has supervised 12 student research projects in the past four years and has experience with helping students obtain results and trouble-shoot research problems.

Of the observers/SPS members Christian Bayens, Matthew Cooper, Tiffany Davis, Koko Himeno, Maisey Hunter, Chase Johnson, Caleb Lane, and Matthew Morgan, five of these students, Christian Bayens, Tiffany Davis, Koko Himeno, Chase Johnson, and Matthew Morgan have taken an observational astronomy course. Christian Bayens and Maisey Hunter have conducted astronomical research projects and presented research at conferences.

References:

(1) Phillips, Tony. “The Exploding Lunar Eclipse.” Science@NASA 27 August 2007. Web. 1 November 2013

(2) Lunar Impacts: http://www.nasa.gov/centers/marshall/news/lunar/program_overview.html

(3) LADEE News and Features: http://www.nasa.gov/mission_pages/ladee/main/index.html

Budget:

Item	Item Description	Cost per Item	Number of Items	Total Cost
1	Watech WAT-902H2 Ultimate CCD	$400.00	1	$400.00
2	Canopus ADVC 110 Digitizer	$200.00	1	$200.00
3	IOTA-VTI Dual GPS Time Stamper	$370.00	1	$370.00
4	OWL Focal Reducer*	$120.00	1	$120.00
			Total Proposed Cost	$1,090.00