Observing Time Request
MDM Observatory

Date: October 14, 2007	*Proposal number:*

TITLE: Prepare for the Moon Princess: High-Res Imaging Coordinated with ***SELENE***

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Abstract of Scientific Justification:

The *SELenological & ENgineering Explorer (SELENE/Kaguya* - after the Greek Moon goddess and a legendary Japanese princess) begins operations in low lunar orbit this November, carrying the most sensitive α-particle detector ever in lunar orbit, arguably the most powerful outgassing detector to survey the lunar surface, heretofore and for the next decade. The $SELENE$ ARD will detect ^{222}Rn (with a half-life of 3.8d) and its decay product ^{210}Po. Previous α detectors reveal ^{222}Rn (from ^{238}U decay) is released episodically, in a few locations. The short list of lunar features which most reliably show transient optical activity entirely contains all of these radon sites. Furthermore, the ^{210}Po decay residual signal, moonquakes, and the optical transient distribution all correlate with the boundaru between basaltic mare plains and the older, fractured highlands. During, before (and presumably after) the $SELENE$ mission we will monitor the surface of the nearside Moon for these optical transients using several small telescopes around the world. Our theoretical models of outgassing events sufficient to produce these optical transients show that a region perhaps 30m across are likely to be strongly disturbed, and ejecta are likely to be lightly scattered over several square kilometers. Since 1 arcsec at the Moon corresponds to 1.9 km, we need subarcsecond imaging in order to resolve the core regions without too much dilution. We propose to use "Lucky Imaging" on the 2.4-meter with a fast-read CCD imager to map large areas of the Moon known and suspected to be active. We will exploit several photometric bands demonstrated to reveal fresh surfaces and freshly disturbed lunar regolith. This imager will provide resolution at the few-hundred km level, which should be adequate for detecting the core of these events. This will be our "before" image for the start of $SELENE$, after we will return to see if the evnts seen by both monitors and by the $SELENE$ ARD have changed in an "after" image.

- *Is this proposal part of a PhD thesis?* N
- *Requesting long-term status? If 'Y', please give # of semesters and nights on the next line.* N

Summary of observing runs requested for this project

Run	Telescope	Instrument, detectors, grisms, gratings, filters, camera optics, etc.
1	2.4m	Andor EMCCD (user instrument), Small Filter Wheel (Large FW O.K.)
2	2.4m	Andor EMCCD (user instrument), Small Filter Wheel (Large FW O.K.)
3		

Run	No. nights	Moon age (d)	Optimal dates	Acceptable dates
1	3	FM−3d to +6d	Feb 16 - 26	Feb - May
2	3	FM−3d to +6d	Feb 16 - 26	Feb - May
3				

- *List dates you cannot use for non-astronomical reasons on the next line.*

Scientific Justification *Try to include overall significance to astronomy.*

Technical and Scientific Feasibility *List objects, coordinates, and magnitudes (or surface brightness, if appropriate), desired S/N, wavelength coverage and resolution. Justify the number of nights requested as well as the specific telescope, instruments, and lunar phase. Indicate the optimal detector, as well as acceptable alternates. If you've requested long-term status, justify why this is necessary for successful completion of the science.*

Why MDM? *If other optical/IR facilities are being used for this project, explain the role that MDM observations will play.*

How is it Going? *List your allocations of telescope time at MDM during the past 3 years, together with the current status of the project (cite publications where appropriate). Mark with an asterisk those allocations of time related to the current proposal. For ongoing projects, are they achieving their goals?*

$\sim$ 20 nights on the 1.3-meter and 2.4-meter M31 microlensing (some in collaboration with other investigators): data through 2001 reduced, 20 new microlensing events found, some reported and scientific meetings and now incorporated in Uglesich Ph.D thesis and ApJ publication, plus two more publications based on KPNO 4m and INT data, and the Cseresnjes et al. *HST* paper. Our MDM images are analyzed and their lightcurves are being incorporated into the larger dataset.

$\sim$ 5 nights on 2.4-meter for QSO target verification for absorption-line studies: data fully reduced and analyzed, absorption-line data being included in upcoming paper (Tytler et al. 2006) on cosmological constant Λ, plus another paper with Lidz and Hui on the value of the cosmological constant, ApJ, in press (astro-ph/0309204). About 20 of these targets have been used for follow-up observations on Keck.

3 nights 2.4-meter for lunar hyperspectral mapping: data analyzed and included in Crotts (2007), ApJ, submitted.

9 nights 2.4-meter for 2005B SDSS SN followup: the 2006 SDSS SN survey yielded almost 200 SN discoveries, and the MDM time accounted for I.D.'s for many dozens of these. The effort distinguished two SNe for our program at Columbia, but we decided not to concentrate on these (instead of 2006X). The Columbia group was identified on 6 CBRT/IAUCs concerning some 52 SNe.

Figures:

Figure 1:

Columbia observing proposal LaTeX macros v2.2.