

Type Progress Report

Grant THERMAL STUDIES OF NEAR EARTH OBJECTS

Number NAG 5-11445

Period Year 1: 3/01/02-02/28/03 (\$58,000)

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Goals

In this proposal, we seek to apply the optical/thermal method to the measurement of the diameters and albedos of a large sample of Near Earth Objects (NEOs). Whereas main-belt asteroids have been studied in large numbers, principally using thermal detections from the IRAS satellite, relatively few thermal observations of NEOs have been secured. This program capitalizes on our access to large telescopes and imaging thermal IR detectors in pursuit of the definitive set of albedo data on the NEOs.

Accomplishments in Year 1

In the first year of this grant we have done the following:

1 We secured 5 nights on the KECK 10-m telescope with the thermal infrared imaging camera LWS. We also secured simultaneous optical time on the University of Hawaii 2.2-m telescope to obtain the full set of data needed for albedo determination. Three of these nights were lost to bad weather on Mauna Kea, a high loss rate that we associate with the incoming period of El Nino.

2 In time secured with a thermal imager at the 3.8-m UKIRT telescope, we took observations of the extraordinarily close near earth object 2002 NY40. Again, simultaneous optical data were obtained at the UH 2.2-m (see Figure 1). These data give us an excellent measure of the albedo and, more importantly, the phase angle dependence of the albedo of this NEO. Determination of the phase angle dependence is one of the prime objectives of this proposal. These results are being written up for publication in Year 2.

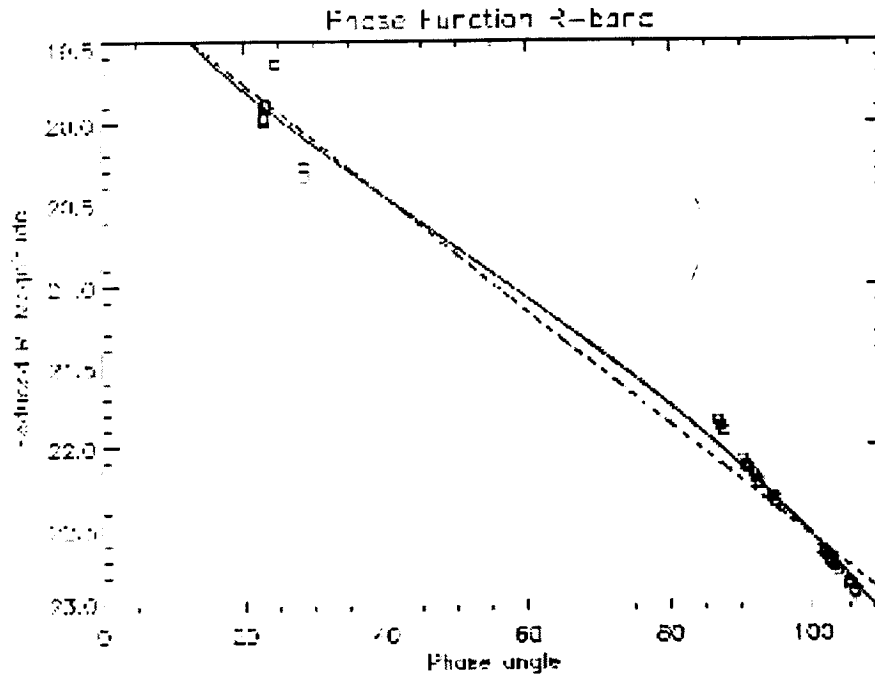


Figure 1: Optical brightness of near-earth object 2002 NY40 on the nights of 2002 Aug 17 and 2002 Aug 18 showing the large (3 mag.) brightness variation across an 80° span of phase angle. Simultaneous thermal infrared observations allow us to measure the albedo and its variation with phase. These results are being written up for publication.

- 3 Dr. Yan Fernandez, supported at the 35% level on this grant, has co-written an invited review about the characteristics of cometary nuclei, in part based on measurements taken under this grant (Campins and Fernandez 2002).
4. The PI has prepared an invited review for the COMETS II book (eds. M. Festou, H. Weaver and U. Keller) that focuses on the dead comets among the NEO population (Jewitt 2003).

Plans for Year 2

- 1 We will complete the analysis and write-up of our excellent 2002 NY40 data and submit this paper for publication.
- 2 We have already secured more thermal IR imaging time on the Keck telescope and will use this to add to our database of thermally measured NEOs. Results from this observational effort will also be written up for publication.
- 3 We will propose for additional thermal time on Keck, Subaru and UKIRT in support of our overall objective in this program, namely, to obtain the definitive sample of NEO thermal/albedo measurements in order to best characterize this population.

Publications of Year 1

H. Campins and Y. R. Fernández 2002. Surface Characteristics of Cometary Nuclei. *Earth Moon & Planets* 89, 117.

Y. Fernandez, D. Jewitt and S. Sheppard (2002). Thermal Properties of Centaurs Asbolus and Chiron. *Astronomical Journal*, 123, 1050-1055.

D. Jewitt (2003). From Cradle to Grave: The Rise and Demise of the Comets. Invited review for COMETS II, edited by M. Festou, H. Weaver and U. Keller. Univ. Az. Press, Tucson, submitted.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION RESEARCH GRANT

1. To: UNIVERSITY OF HAWAII
OFFICE OF RESEARCH SERVICES
2530 DOLE ST/SAKAMAKI D-200
HONOLULU, HI 96822-3203

2. Grant Number: **NAG5-11445**
3. Supplement: **BASIC**
4. Effective Date: **3/1/2002**
5. Expiration Date: **2/28/2005**

VID: U090061 CAGE CODE: 0W411 TIN: 99-6000354

6. For research entitled:
THERMAL STUDIES OF NEAR EARTH OBJECTS

7. Under the direction of (Principal Investigator): **DAVID JEWITT**

8. Award History

Previous amount: **\$0.00**
This action: **\$58,000.00**
Total to date: **\$58,000.00**

Funding History

Previous obligation: **\$0.00**
This action: **\$58,000.00**
Total obligation to date: **\$58,000.00**

9. Accounting Data: **OBJECT CLASS: 4111**

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AMOUNT
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Grant negotiator: **WINIFRED R OTTEN**
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Letter of Credit: **030**

11. This grant is awarded under the authority of 42 U.S.C. 2473 (c) (5), et seq., and is subject to all applicable laws and regulations of the United States in effect on the date this grant is awarded, including but not limited to 14 CFR Part 1260 (Grants and Cooperative Agreements).

12. Applicable statement if checked:

The Federal Demonstration Partnership General Terms and Conditions and NASA Agency-Specific Requirements to this award.

No change is made to existing provisions or special conditions.

Secondary Administration Delegation

UNITED STATES OF AMERICA

Applicable enclosure(s), if checked:

Provisions

Special conditions

Required Publications and Reports


WINIFRED R. OTTEN (Date) **DEC 21 2001**

Contracting Officer

For access to the NASA Grants and Cooperative Agreement Handbook and status of any future GSFC Grant awards, visit <http://genesis.gsfc.nasa.gov/grants/grants.htm>

RESEARCH GRANT

02 JUN -4 A9:37



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ADDITIONAL TERMS

NAG5-11445

THE PERIOD OF PERFORMANCE FOR THIS GRANT IS 36 MONTHS.

THIS AWARD PROVIDES FUNDING FOR YEAR 1 OF A 3 YEAR PROPOSAL;
THEREFORE, A NEW TECHNICAL PROPOSAL IS NOT REQUIRED.

THIS GRANT DOES NOT PROVIDE FOR INITIAL CASH PAYMENT. FUNDS WILL BE OBTAINED BY THE LETTER OF CREDIT METHOD OF OBTAINING CASH. NO PART OF SUCH FUNDS SHALL BE PAID IN ADVANCE TO ANY SECONDARY RECIPIENT WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE GRANTS OFFICER. CASH DRAWDOWNS ARE TO BE INITIATED ONLY WHEN ACTUALLY NEEDED FOR DISBURSEMENTS OF OR APPROVED SECONDARY RECIPIENTS. STANDARD FORM 272, "FEDERAL CASH TRANSACTIONS REPORT," COVERING CASH DISBURSEMENTS AND BALANCES SHOULD BE SUBMITTED TO CODE 155, COST AND COMMERCIAL ACCOUNTS, WITHIN 15 WORKING DAYS FOLLOWING THE END OF EACH QUARTER.

THE ADMINISTRATION OF THIS AWARD IS SUBJECT TO THE FEDERAL DEMONSTRATION PARTNERSHIP PROVISIONS.



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SPECIAL CONDITIONS

NAG5-11445

§ 1260.52 MULTIPLE YEAR GRANT or COOPERATIVE AGREEMENT (October 2000)

This is a multiple year grant or cooperative agreement. Contingent on the availability of funds, scientific progress of the project and continued relevance to NASA programs, NASA anticipates continuing support at approximately the following levels:

Second Year	\$59,000.00	,	Anticipated Funding Date	3/1/2003	.
Third Year	\$61,000.00	,	Anticipated Funding Date	3/1/2004	.