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***Palomar Planet-Crossing Asteroid Survey (PCAS)***

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***Strategy***

The objective of this program is the discovery and follow-up of planet-crossing asteroids, related inner-belt asteroids and comets. The primary program is carried out with the 0.46 m Schmidt telescope at Palomar Observatory. The results, subsequent observations, and analysis provide insight into their populations, orbits, origins, physical characteristics (composition, size, shape), potential for impact, relationships to comets and meteorites, and for future spacecraft mission candidates.

***Progress and Accomplishments***

14 Near-Earth Asteroids (NEA's), 5 Apollos and 9 Amors, were discovered in the last 14 months, an unprecedented number of discoveries in such a short period. This high discovery rate reflects still greater sky coverage, improvement in focus and threshold detection. In addition, 254 other asteroids of all classes were discovered, reported and given designations including 43 high inclination asteroids (17 Hungarias and 26 Phocaeas). Several of the NEA's (1990 MF, 1990 OS, 1990 UA and 1991 AC) made close approaches to the Earth allowing successful radar observations. An unexpected, very bright discovery was made, 1990 SQ and observed for over 5 months. It is the brightest asteroid yet found in the earth-crossing population. It has an absolute magnitude,  $H=12.5$ , ~10 km in diameter. (1627 Ivar had been the previous record holder.) At the other extreme, two very faint,  $H=20$ , were found. They have very low inclinations of  $<1$  degree which when combined with their other orbital elements indicates that they could be Earth impactors in the future. 13 asteroids have been permanently numbered and another 15 previously numbered have been officially named. Of the newly numbered, two are NEA's. Our best observed mission candidate, 1982 DB, was recovered and numbered (4660). It offers several opportunities for low delta V spacecraft missions in the next decade.

***Projected Accomplishments***

Continuing progress is anticipated in the automated identification and measurement procedures. With diligence and fine tuning, we plan to maintain and improve our results. However, a major increase in our rate of discovery will require an upgrade to a large CCD array retrofitted on the 0.46 m Schmidt. Along with our primary NEA program, we will continue our studies and analysis of inner-belt asteroid regions.

## ***Publications***

Helin, Eleanor F. and Brian P. Roman (1989) "High Inclination Inner-Belt Asteroids: Hungarias and Phocaeas", in *Asteroids, Comets, Meteors III*, (Lagervist, C-I., Lindblad, B.A., Lundtedt, H., and Rickman, H. Eds), pp.105-108.

Helin, E. F. and R. S. Dunbar (1990) "Search Techniques for Near-Earth Asteroids", *Vistas in Astronomy*, V. 33, No. 1, pp. 21-37.

Helin, E.F., Roman, B.P., Alu, J.T. (1990) "Comets Discovered by PCAS in 1989", *Lunar and Planetary Science Conference XXI Proc.*, Part 2, p.492.

Helin, E.F., Roman B.P., Lawrence K.J. (1990) "Near-Earth Asteroids: Need for Physical Observations at Discovery Apparition", *Meteoritical Meetings*, Perth, Australia, Sept. 1990.

Helin, E.F., Roman, B.P., Lawrence K.J. (1990) "Proliferation of Near-Earth Asteroid Discoveries", *AAS, DPS*, Charlottesville, Va., Nov. 1990.

## **Discovery and Astrometric Position Publications**

### **International Astronomical Union Circulars:**

1990: 4951, 4952, 4954, 5001, 5018, 5025, 5041, 5044, 5045, 5056, 5063, 5064, 5103, 5120, 5147, 5150

1991: 5171, 5177, 5194, 5198

### **Minor Planet Circulars:**

1990: 15603-607, 15625-629, 15811-820, 15946-948, 15967-977, 16122-124, 16145-146, 16294-301, 16335-342, 16480-483, 16521-526, 16652-655, 16671-674, 16772-776, 16802-827, 16958-986, 17106-130, 17331-346

1991: 17525-562, 17710-717