Near Earth Object Observations Program

Close Approaches of 2011

Presentation to
UN COPUOS
Scientific & Technical Subcommittee

Lindley Johnson
Program Executive
NASA HQ
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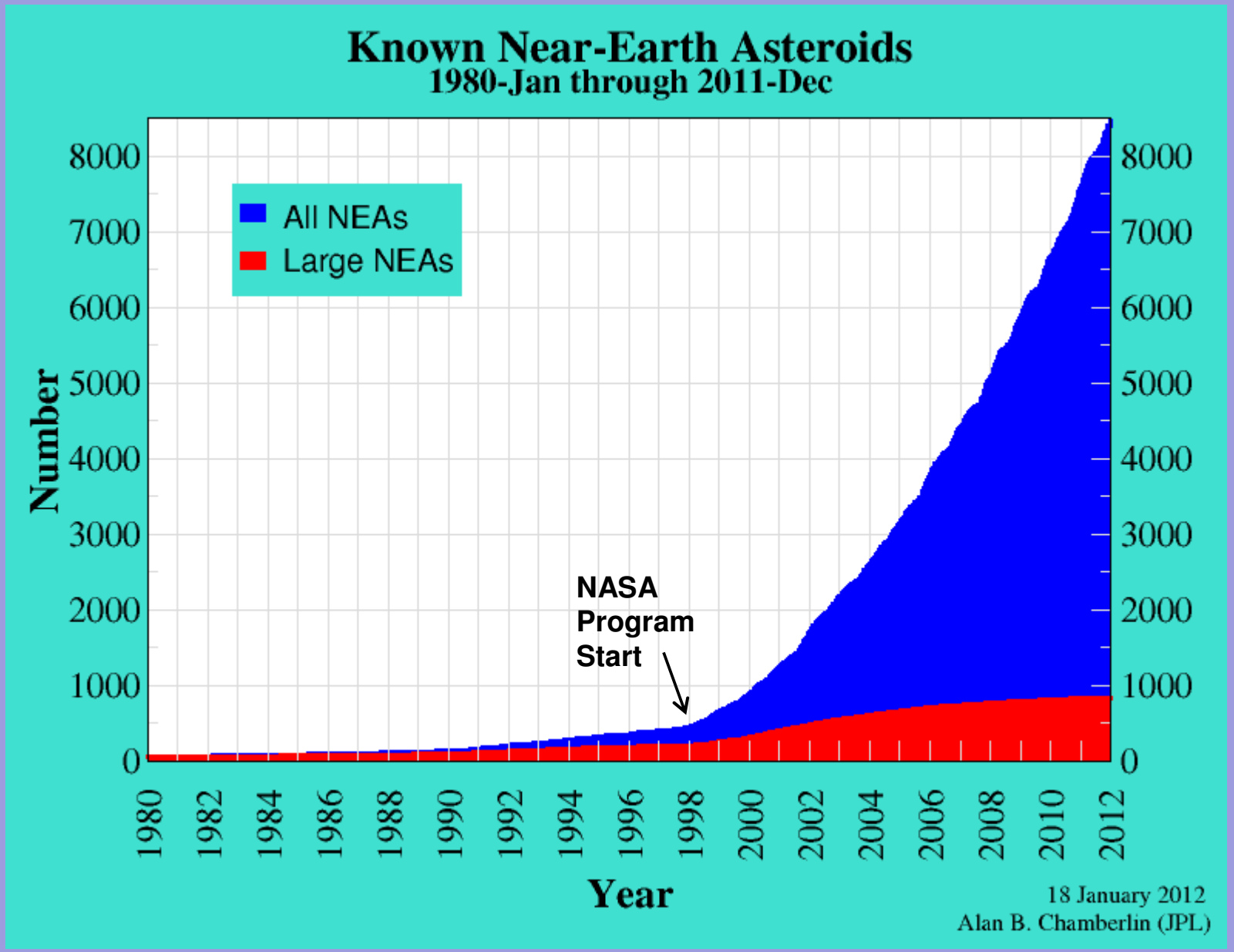
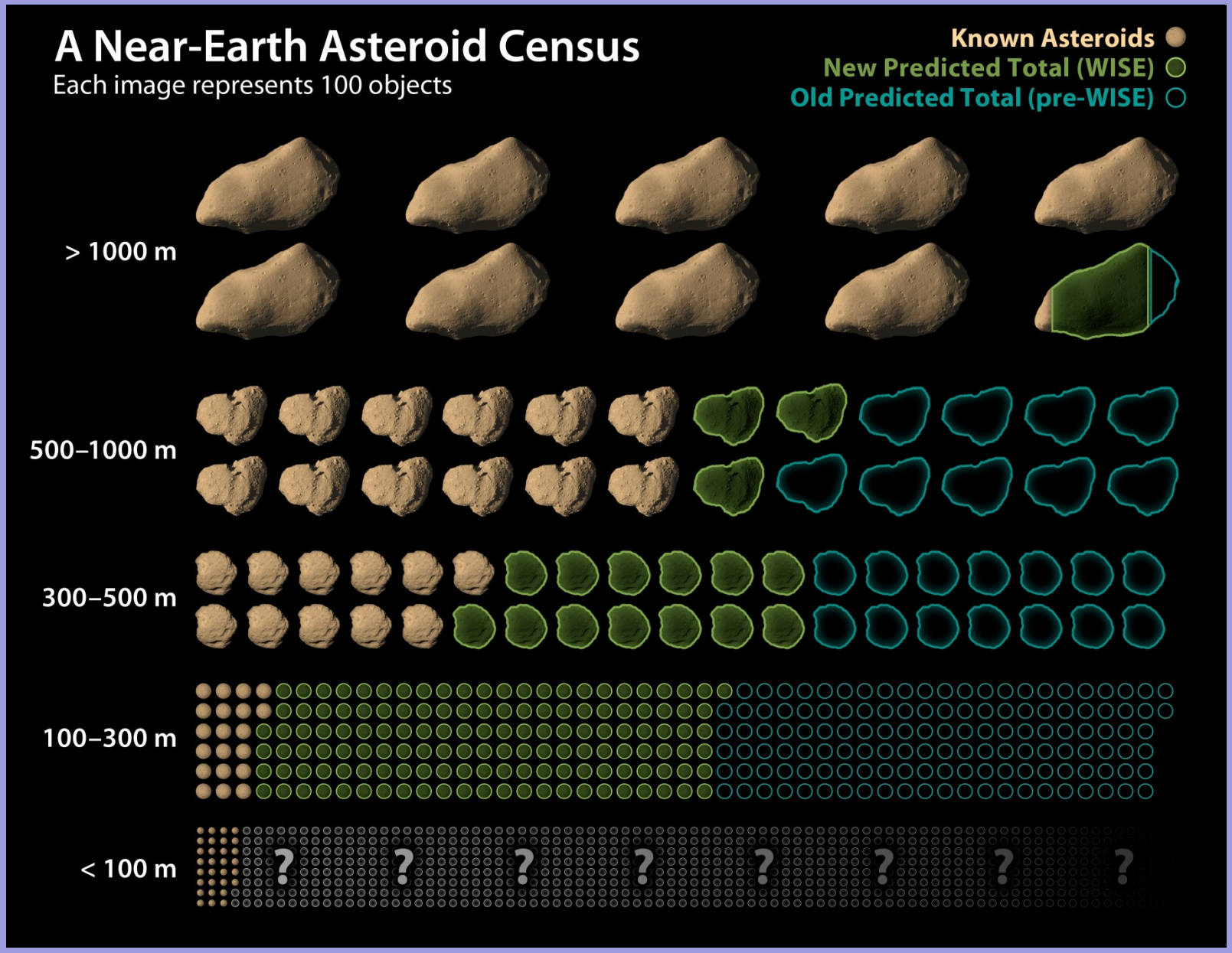
Continued Survey Success



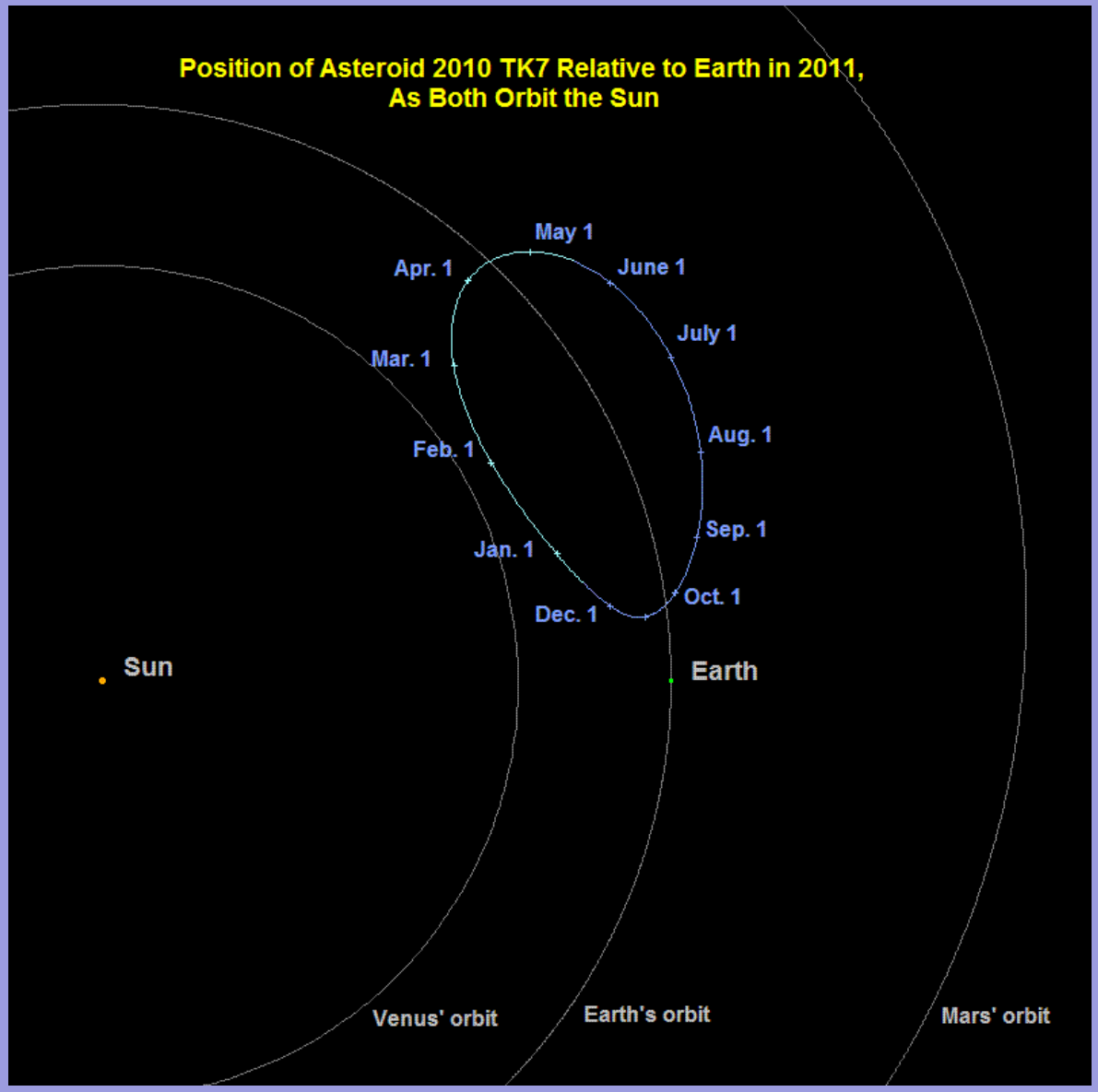
Improved Population Estimate by NEOWISE



First Discovery of an Earth Trojan Asteroid

A team led by Martin Connors of Athabasca University, Canada, announced discovery of Earth's first Trojan asteroid. The object was first detected by NASA's Wide-field Infrared Explorer (WISE) mission, and follow-up observations by Connors and his team confirmed the asteroid's Trojan nature.

This diagram shows the motion of 2010 TK7 in 2011 relative to Earth, looking down from above the Solar System. Although Earth and asteroid both actually orbit the Sun, the relative motion appears as a large loop leading the Earth in its orbit.



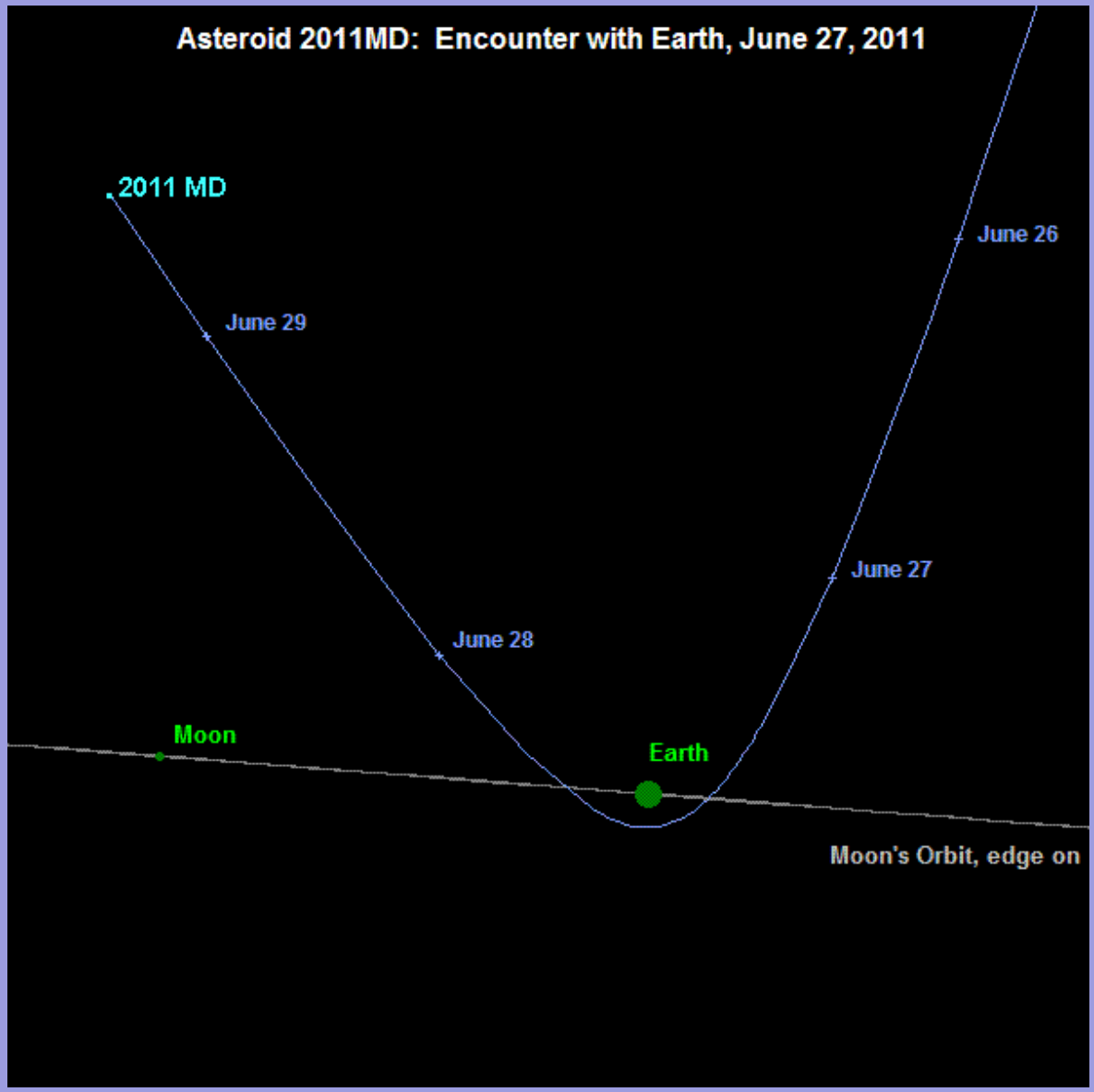
Close Approaching Asteroids in 2011

Object	Closest Approach Date -Time	Min Dist. x Lunar	Relative Velocity (km/sec)	H Mag(v)	Size meters (est)
2011 CQ1	2011-Feb-04 19:38	0.03	9.69	32.0	1
2011 MD	2011-Jun-27 17:00	**0.05**	6.70	28.1	14
2011 CF22	2011-Feb-06 11:39	0.1	19.60	30.9	3
2011 GP28	2011-Apr-06 19:39	0.2	14.80	29.4	6
2011 TO	2011-Sep-28 15:25	0.3	8.87	26.3	32
2011 BW11	2011-Jan-25 06:33	0.3	23.95	28.3	12
2011 EY11	2011-Mar-07 03:26	0.3	11.86	28.6	10
2011 YC40	2011-Dec-28 02:29	0.3	11.36	29.7	5
2011 AM37	2011-Jan-11 11:46	0.3	4.41	29.7	5
2011 CA7	2011-Feb-09 19:27	0.3	9.33	30.3	4
2011 OD18	2011-Jul-28 08:38	0.4	9.54	26.5	30
2011 UX255	2011-Oct-28 17:42	0.4	26.96	27.4	21
2011 GW9	2011-Apr-06 04:53	0.5	11.36	28.1	14
2011 UT	2011-Oct-12 19:14	0.6	10.17	25.8	40
2011 CA4	2011-Jan-31 04:08	0.6	6.00	27.0	24
2011 SE58	2011-Sep-27 02:46	0.6	15.85	27.6	19

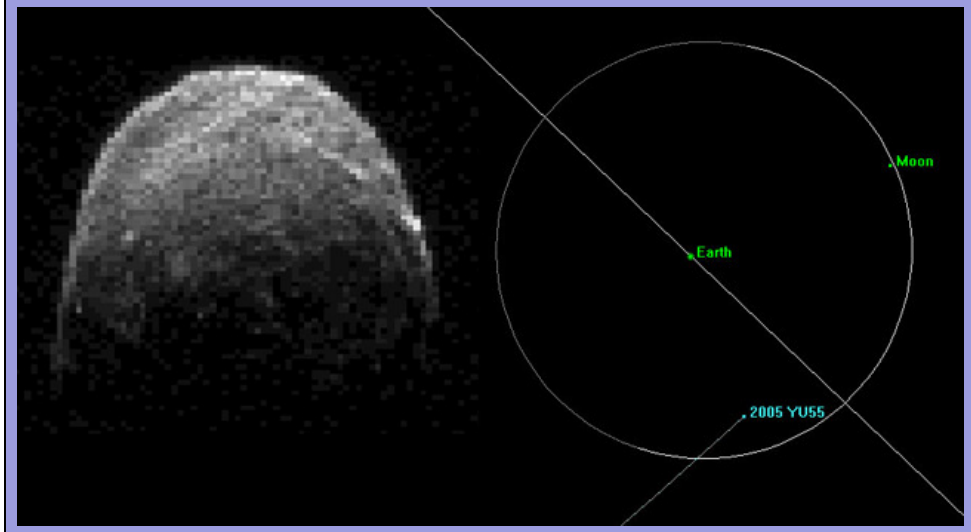
Object	Closest Approach Date -Time	Min Dist. x Lunar	Relative Velocity (km/sec)	H Mag(v)	Size meters (est)
2011 EN11	2011-Mar-03 08:47	0.6	11.21	27.9	16
2011 EM40	2011-Mar-08 04:05	0.6	10.79	28.0	15
2011 YC63	2011-Dec-30 02:16	0.6	18.80	29.0	8
2011 DU9	2011-Feb-23 19:03	0.7	8.92	26.7	28
2011 UL169	2011-Oct-26 02:31	0.7	9.54	28.3	12
2012 AQ	2011-Dec-29 08:32	0.7	3.28	30.7	3
2005 YU55	2011-Nov-08 23:28	0.8	13.72	21.1	**380**
2011 SM173	2011-Sep-30 17:02	0.8	12.71	27.8	17
2011 AN52	2011-Jan-17 23:19	0.8	15.92	28.5	11
2011 XC2	2011-Dec-03 15:20	0.9	20.93	23.0	150
2011 PU1	2011-Jul-24 19:27	0.9	5.60	25.1	60
2011 EB74	2011-Mar-16 21:54	0.9	7.71	26.9	25
2011 BY10	2011-Jan-20 08:29	0.9	7.84	27.3	22
2009 BD	2011-Jun-02 00:51	0.9	1.91	28.3	12
2009 TM8	2011-Oct-17 11:09	0.9	8.18	28.6	10
2011 JV10	2011-May-05 17:13	0.9	5.33	29.7	5
2011 YQ1	2011-Dec-14 14:19	1.0	11.79	25.6	50

Close Approach of Asteroid 2011 MD

Asteroid 2011 MD passed only 12,300 kms (7,600 miles) above the Earth's surface on Monday June 27. The NEO was discovered by NASA's LINEAR asteroid search team observing from Socorro, New Mexico. The diagram to the right gives a view looking from the general direction of the Sun that indicates that 2011 MD reached its closest Earth approach point in extreme southern latitudes - in fact over the southern Atlantic Ocean.

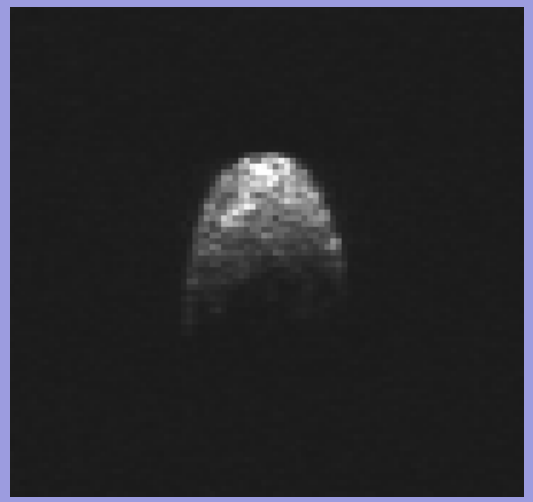


Pass of Asteroid 2005 YU55 Observed with Ground-based Radars



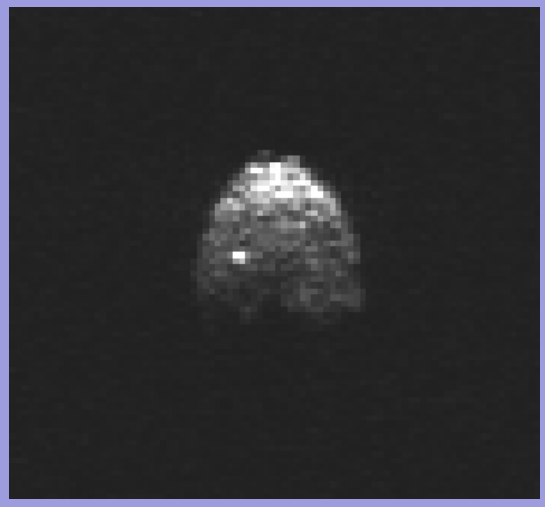
This image of asteroid 2005 YU55 with about 12 foot resolution was obtained by Lance Benner at NASA's Goldstone Radar on Nov. 7, 2011, about one day before closest approach, when the object was at 3.6 lunar distances, which is about 860,000 miles from Earth. NASA/JPL-Caltech

- 2005 YU55 passed by Earth the evening of 8 Nov, 2 at just less than 200,000 miles – within the Moon's orbit
- Earth based planetary radars at Goldstone, CA and Arecibo, PR, were used to track and image the asteroid
- Planetary radar can be used to determine the size and shape of the asteroid, study its surface properties, and help predict any future encounters with the Earth
- The radar imaging shows the asteroid to be roughly spherical, about 1300 feet across, and rotating with a period of about 18 hours
- This event demonstrates how Near Earth Asteroids could be characterized by planetary radar for studies of potential human spaceflight destinations

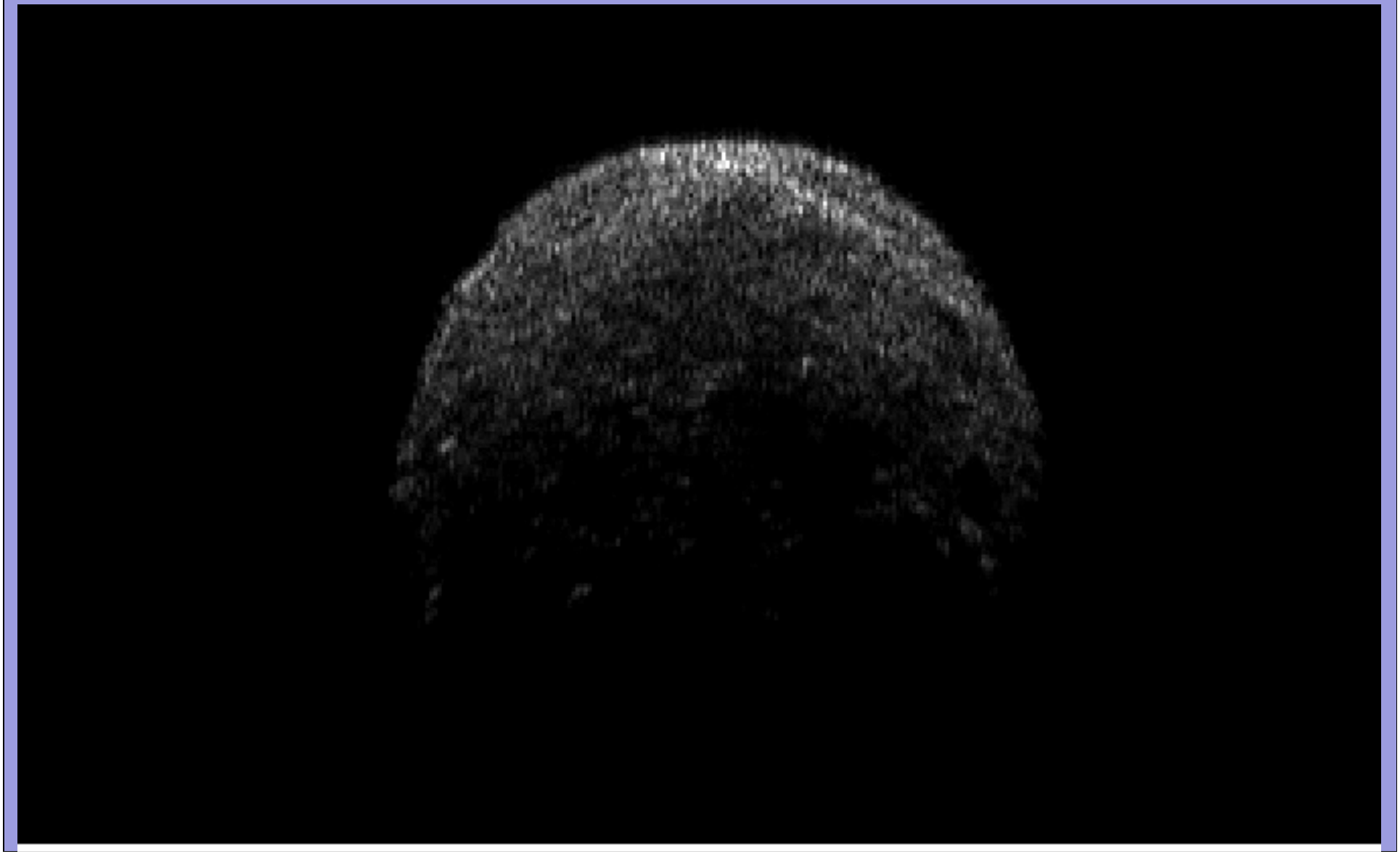


These two radar images were obtained by Patrick Taylor at the Arecibo Planetary Radar on Nov 12. The asteroid was about 2,000,000 miles away and the images show objects of about 25 feet in size. The image on right shows a radar bright feature, possibly a boulder on the asteroid's surface.

The Arecibo Observatory is operated by SRI International under a cooperative agreement with the National Science Foundation, in alliance with Ana G. Méndez-Universidad Metropolitana, and the Universities Space Research Association. The radar operations are funded by NASA.



Radar Rotation Study of 2005 YU55



Goldstone Radar Improves Asteroid 2005 YU55 Orbit Knowledge

These orbit diagrams show our prediction of where 2005 YU55 would be in March 2031 and in February 2050, first before the Nov 8 2011 radar observations (on the left) and then after those observations (on the right).

The November observations have allowed us to narrow the uncertainty in position from almost 20% of the orbit, in the 2050 case, to almost a point 40 years into the future.