



ESO observations of potentially hazardous NEOs

Claus Madsen (Cabinet of the Director General) and
Olivier Hainaut (Senior Astronomer)





- Active participation in AT-14 since 2005
- Recommendations to Member States endorsed by UN GA in 2013
- Established an internal expert group to “use ESO’s large telescopes to perform critical observations that cannot be done elsewhere”.
- Carries out astrometric observations of ‘critical’ NEOs in coordination with ESA (in the frameworks of the ESA SSA and the ESO DDT monitoring ToO programmes)
- Joined IAWN in 2015



This ESA/ESO astrometric campaign:

- Faint objects with a high value on the Palermo scale* which cannot be observed with smaller telescopes;
- Recently discovered NEOs which are rapidly fading** below the detection threshold for smaller telescopes before their orbit can be secured.

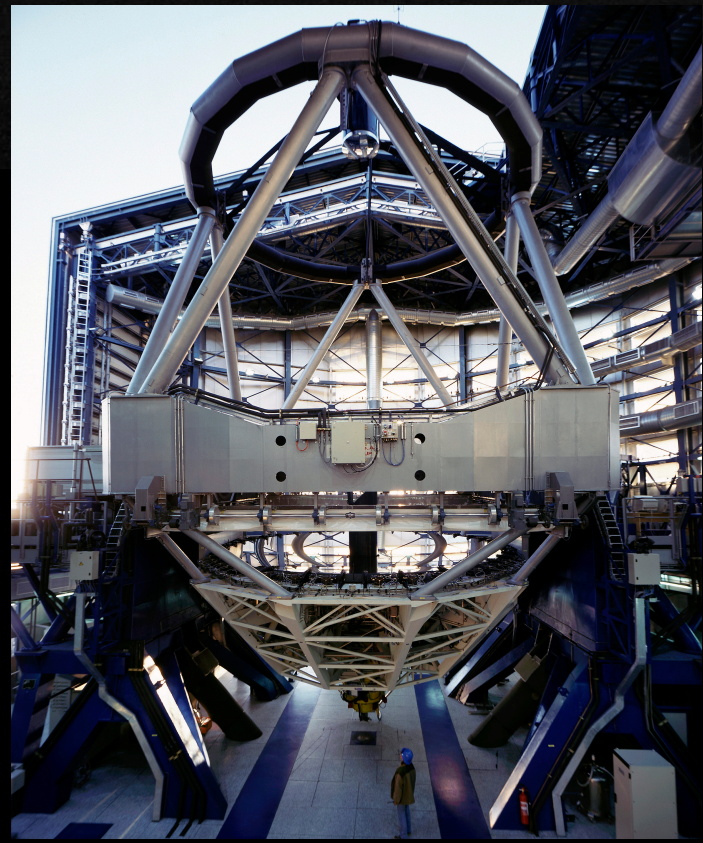
The VLT astrometry refines orbits, ensuring that objects shall not be 'lost', and clarifying their status as potential impactor.

**index > -6 on the Palermo Scale*

***typically, with visual magnitude in the 23-26.5 range*

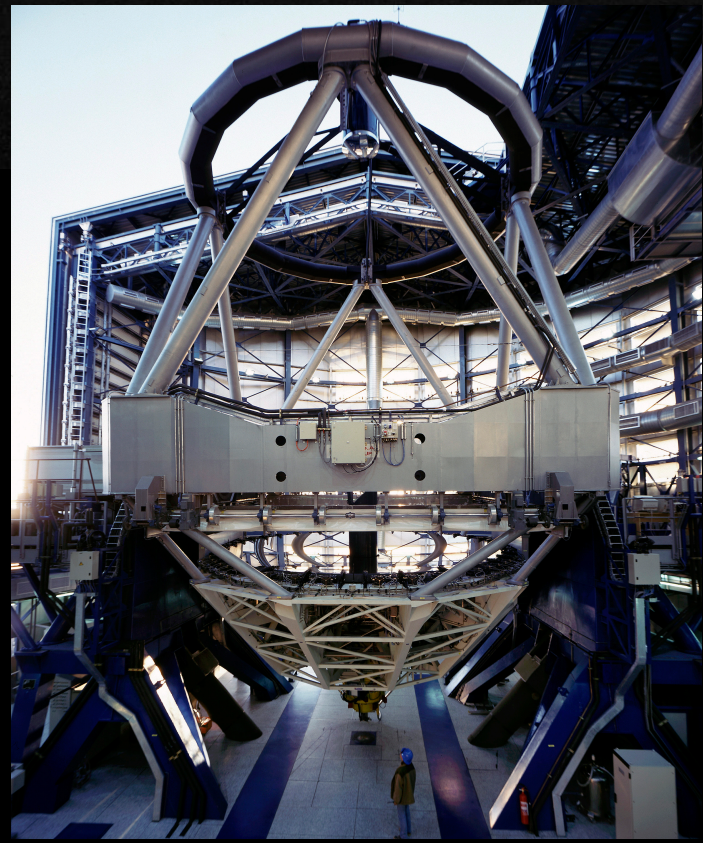


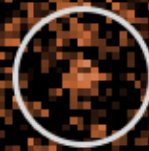
- Observations with the 8.2-metre Unit 1 Telescope (Antu) of the ESO Very Large Telescope (VLT) at Cerro Paranal (Chile)
- Observations can be scheduled at very short notice
- Observations since October 2013 at the level of 11h per semester, which corresponds to ~20 objects per year.





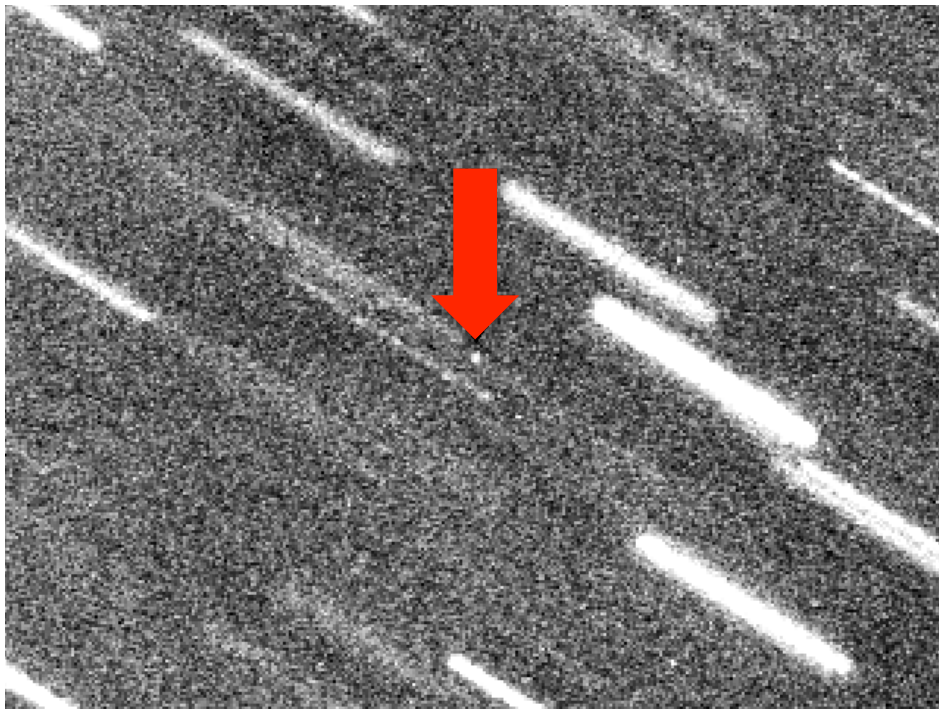
- Data are retrieved and processed at the ESA NEO Coordination Centre (NEOCC) in Frascati , resulting in an improved orbit.
- The measured positions are also reported to the Minor Planet Center, and
- independently analysed by the JPL-based Sentry system.





2009FD





2004 WF6, at magnitude $V=26.4$, the faintest NEO recovery.

Object	Obs.date	PS before	PS after	Comment
2009 FD	2013-Nov-30	-1.8	-2.60	Recovered
2013 YC	2014-Jan-22	-2.9	-inf	Extended
2014 AF16	2014-Mar-11	-2.4		
"	2014-Apr-01		-inf	Extended
2014 DN112	2014-Mar-28	-3.1	-3.60	Extended
2014 EU	2014-Mar-28	-6.6	-6.60	Extended
2013 YD48	2014-Apr-09	-3.5	-4.80	Extended
2012 HP13	2014-Apr-09	-6.6	-inf	Recovered
2014 DN112	2014-May-01	-3.6	-inf	Extended
2014 GY44	2014-May-01	-9.2	-6.70	
"	2014-May-28	-6.7	-6.40	Extended
2014 FX32	2014-May-01	-5.4	-5.40	
"	2014-May-28	-5.4	-5.10	Extended
2014 HM129	2014-May-22	-4.2	-inf	Extended
2014 HM187	2014-May-28	-4.5	-inf	Extended
2012 VU76	2014-May-28	-6.1		
"	2014-Jun-15		-inf	Recovered
2013 XK22	2014-May-28	-4.4		
"	2014-Jun-15		-4.92	Extended
2013 YD48	2014-Jun-15	-4.8	-inf	Extended
2011 PU1	1900-Jan-05	-4.3	-inf	
2014 KS76	2014-Jun-15	-7.5	-8.28	Extended
2014 LJ	2014-Jun-15	-7.8	-7.90	Extended
2014 WF6	2014-Dec-17	-5.07	-3.99	
"	2015-Jan-15	-3.99	-7.20	Extended
2014 WA201	2014-Dec-17	-5.71	-4.94	Extended
2014 OO6	2014-Dec-17	-3.91	-6.37	Extended
2014 XL7	2015-Jan-15	-3.1	-inf	Extended
2003 LN6	2015-Jan-23	-5.22		
"	2015-Feb-24		-5.22	Recovered
2014 WP362	2015-Mar-23	-5.31		
"	2015-Apr-08		-inf	Extended
2015 DD54	2015-Mar-30	-6.66	-6.60	Extended
2014 WP362	2015-Apr-10	-7	-inf	Extended
2008 LG2	2015-Jun-15	-6.13		
"	2015-Jul-07		-inf	Recovered
2015KP18	2015-Jun-16	-3.79	-7.30	Extended
2003LN6	2015-Jun-26			Observations failed
2000UK11	2015-Aug-25	-5.62		Recovered
"	2015-Aug-28			
"	2015-Sep-11		-inf	
2015PL57	2015-Sep-09	-5.17		
"	2015-Oct-13		-9.14	Extended
2005VN5	2015-Sep-18	-5.69		Not found
2015SSG	2015-Oct-15	-5.3	-8.58	Extended
2015KP18	2015-Dec-12	-3.8	-7.30	Extended
2006XP4	2015-Dec-13	-7.34	-inf	Recovered; confirmed by collaborators
2015VD2	2015-Dec-12	-5.3	-8.45	Extended
2006QV89	Pending	-3.81		(recovery)
2008EX5	Pending	-4.55		(recovery)
2013GM3	Pending	-5.32		(recovery)





- 22 NEOs were removed from the "risk list", or pushed to very low level of Palermo Index.
- For another 12 objects, the orbit has been improved, securing them for future observations, but their Palermo Index is still high.
- The orbit of 3 more objects were improved, but resulting in a higher Palermo Index: these are actually more risky than previously though. Fortunately, none has risen to become known future impactors.



- A total of 37 objects observed until today.
- The NEODyS risk list contains typically ~100-120 objects.



Thank you for your attention!

