



# 67<sup>th</sup> IAC

## International Astronautical Congress

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# Study on NEO Impact and Warning System utilizing Artificial Equilibrium Point Orbit

IAC-16,A3,IP,1,x34377

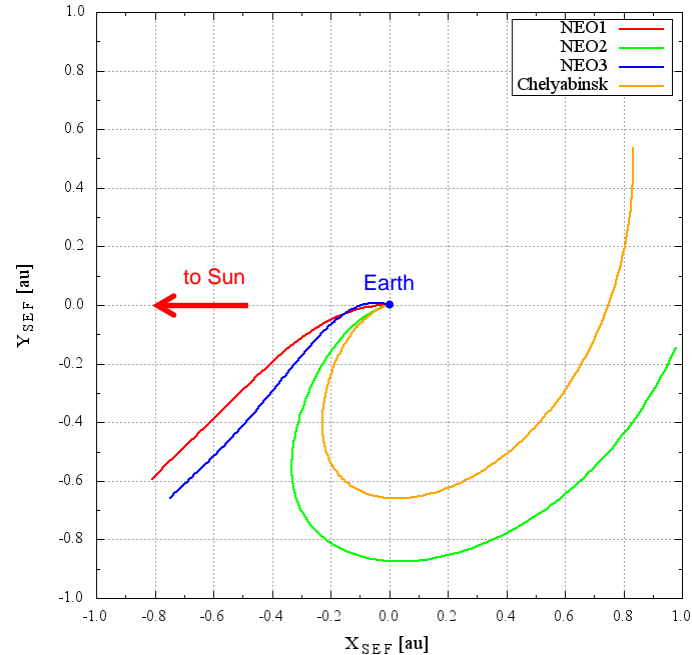
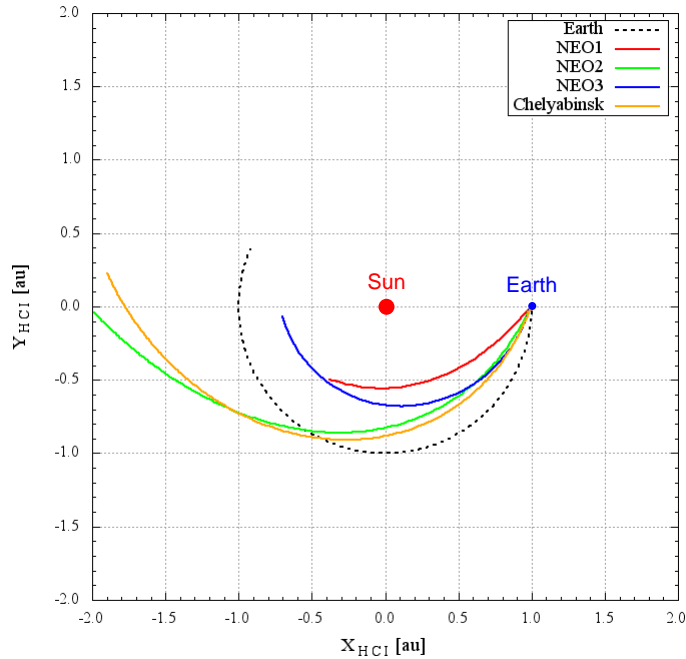
T. Ikenaga, M. Jocqueviel, Y. Sugimoto, H. Ikeda,  
A. T. M. Gagliardi, M. Yoshikawa, M. Utashima  
and N. Ishii



# IAC 2016 Guadalajara



# Background



Chelyabinsk meteor was only 20 meters size, also it approached to Earth from Sun direction, which made it impossible for ground observatory to detect it before the impact.

→ **We propose Detection and Warning System for such small hazardous NEOs.**

# Where is the best location for space-telescope?

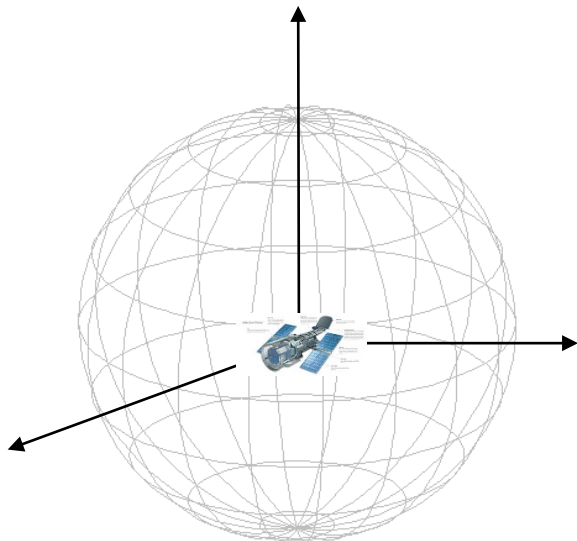
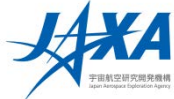


Table shows TOF to Earth impact computed by 25,000 VIs based on Bottke model.

Range from Earth	Average TOF to Impact	Minimum TOF to impact
0.5 au	22.7 days	18.1 days
0.4 au	20.2 days	14.7 days
0.3 au	16.9 days	11.1 days
0.2 au	12.7 days	7.5 days
<b>0.1 au</b>	<b>6.9 days</b>	<b>3.8 days</b>

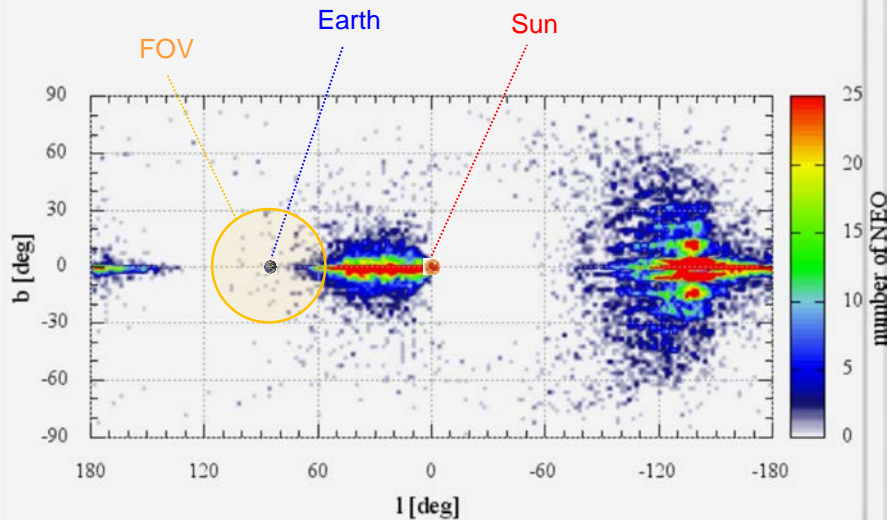
→0.1 au may be the limit for evacuation.

Space-telescope observes Earth with 30-deg radius FOV to detect Earth impacting NEOs before the impact.

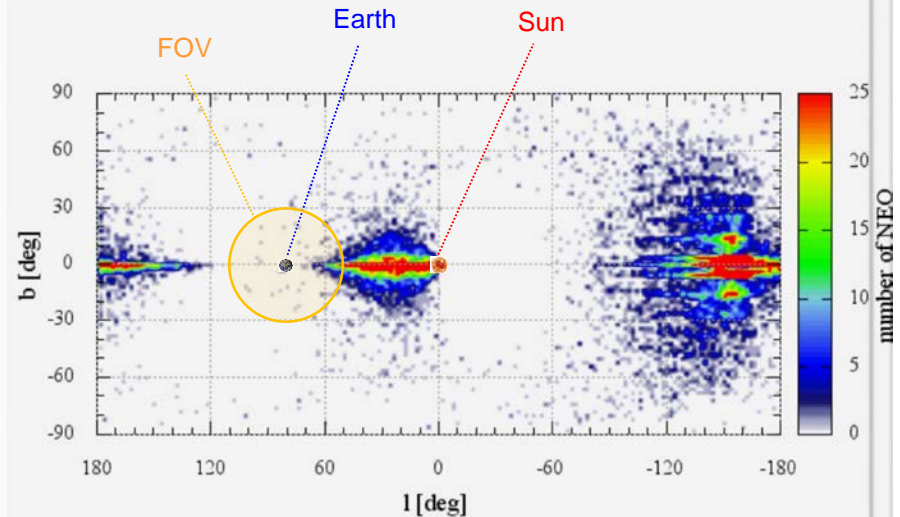
# NEO distribution in telescopic view

Video shows the movement of the “cloud” of 25,000 Virtual Impactors. VIs approach to Earth from 1.0 au distance from Earth.

When seen from AEP sufficiently far from Earth, **NEO cloud with 0.1 au radius comes into FOV.**



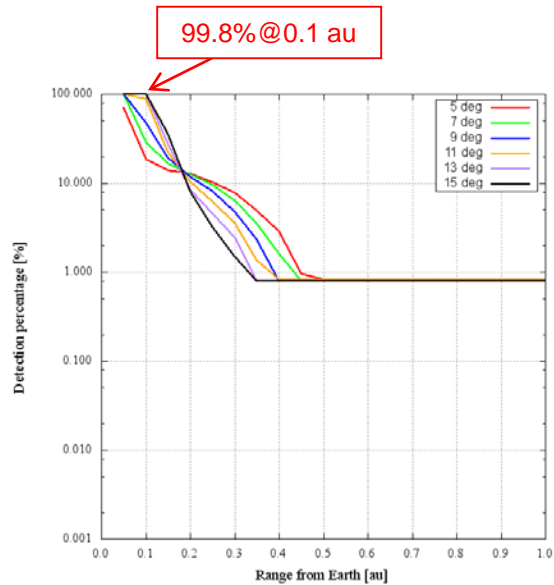
a) View from 9 deg AEP



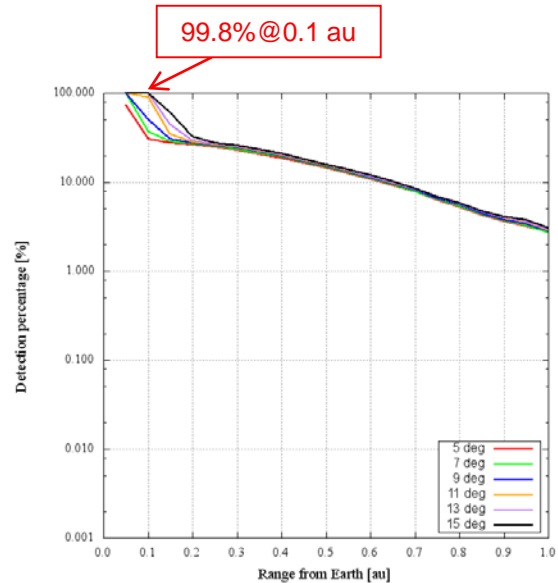
b) View from 17 deg AEP

# NEO detection capability

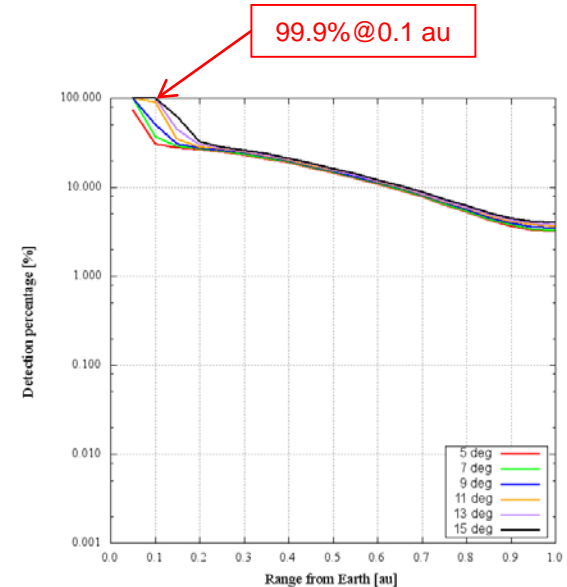
Figures show detection results with 24 detectable magnitude(near future?).  
It can detect almost all 25 meters size i.e., Chelyabinsk-class.



a) 25 m



b) 50 m



c) 140 m

# Summary



- A new mission concept of **Hazardous NEOs Detection and Warning System** is proposed.
- This concept focuses on early detection of **small size of NEOs** which are hardly discovered until they come close to Earth, like **Chelyabinsk meteor**.
- The study shows:
  - Telescope with 20 detectable magnitude → will work for 140 meters size at 0.1 au from Earth.
  - Telescope with 22 detectable magnitude → will work for more than 50 meters size at 0.1 au from Earth.
  - Telescope with 24 detectable magnitude → will detect more than 25 meters size at 0.1 au from Earth.

→ Please see the manuscript “IAC-16-A3.IP.1.x34377” for detail information.