

# CFHT STUDY OF TNOS - SEARCHING OF RESONANT TNOS BY NGVS

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2009/12/08

NCU-CPS workshop

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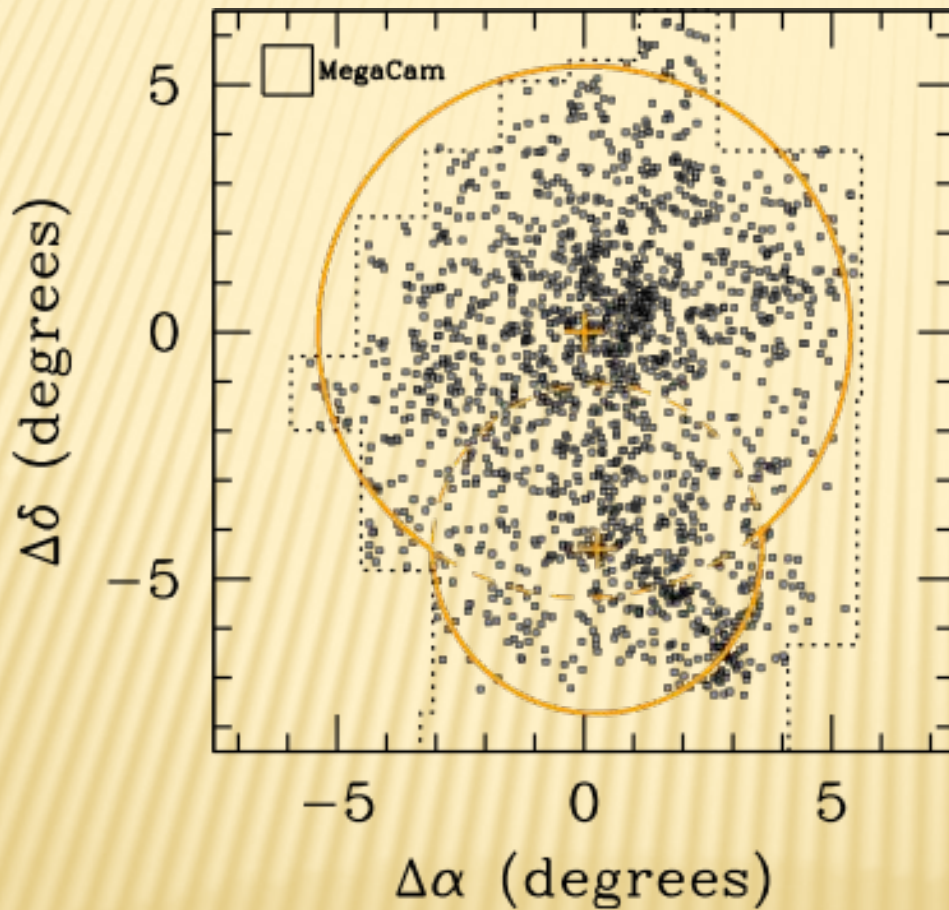
# WHAT'S NGVS

- ✘ The **Next Generation Virgo Cluster Survey** (NGVS) is an approved Large Programme for the Canada French Hawaii Telescope (CFHT).
- ✘ The NGVS will use **771 hours of CFHT time** (approx. 140 nights), spread equally over the **2009A-2012A** semesters,
- ✘ To image the Virgo Cluster - the dominant mass concentration in the local universe and the largest collection of galaxies within  $\approx 35$  Mpc - from its core to virial radius, **in five filters (u,g,r,i,z)**, to unprecedented depths.



etc

# THE SURVEY



Depth (points source, S/N=10)

$u^*$  = 25.9 AB mag

$g'$  = 25.7 AB mag

$r'$  = 25.2 AB mag

$i'$  = 24.9 AB mag

$z'$  = 24.6 AB mag



# SCIENCE ON NGVS

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- ✘ NGVS PI: Laura Ferrarese,  
co-PI of KBOs: JJ Kavelaars  
(NRC Herzberg Institute of Astrophysics, Canada)
- ✘ Virgo science
  - The faint-end shape of the luminosity function
  - The characterization of galaxy scaling relations
  - Connection between stellar nuclei and supermassive BHs
  - Connection between cluster, galaxies and the ISM
  - Star formation and chemical enrichment
- ✘ Background science
  - Galactic extinction
  - background structures
- ✘ Foreground science
  - the shape and symmetry of the stellar halo
  - KBOs and planetary formation**

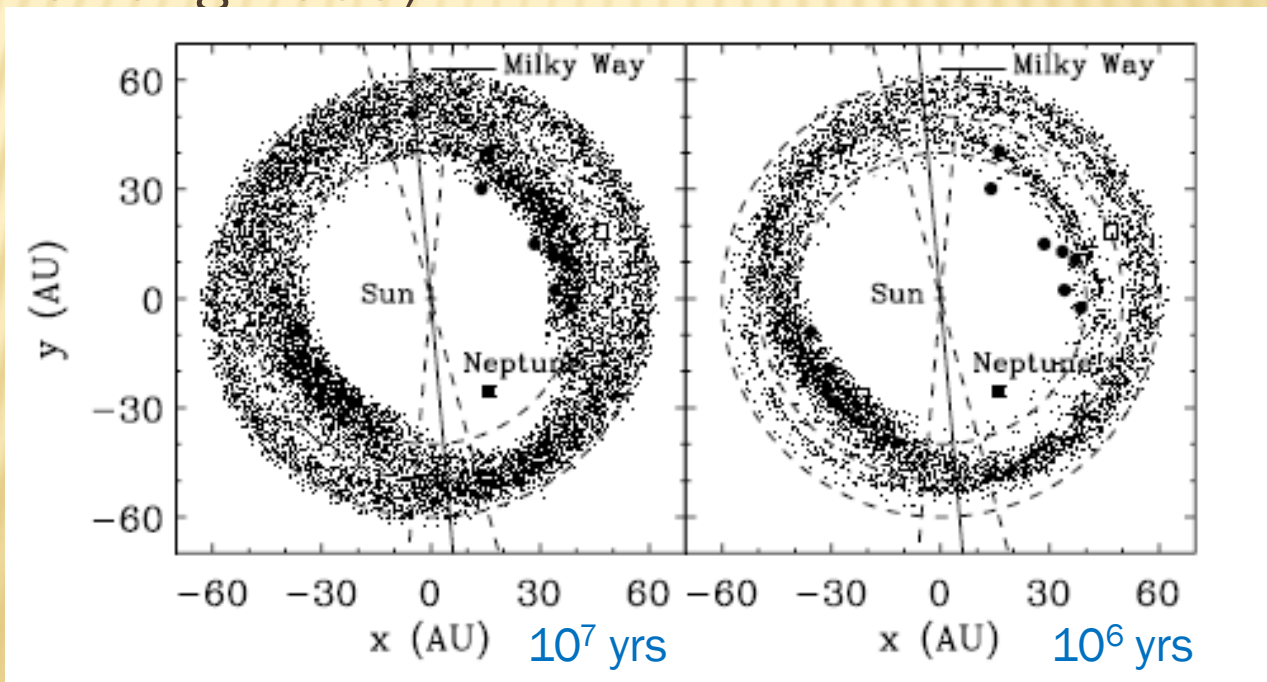
# RESONANT TNOs

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- ✘ As TNOs were discovered, a substantial proportion were found to be in resonances with Neptune, far from being a random distribution. It is now generally believed that these objects have been collected from wider distances by **sweeping resonances** during the **outward orbital migration of Neptune**. (Malhotra, 1995).

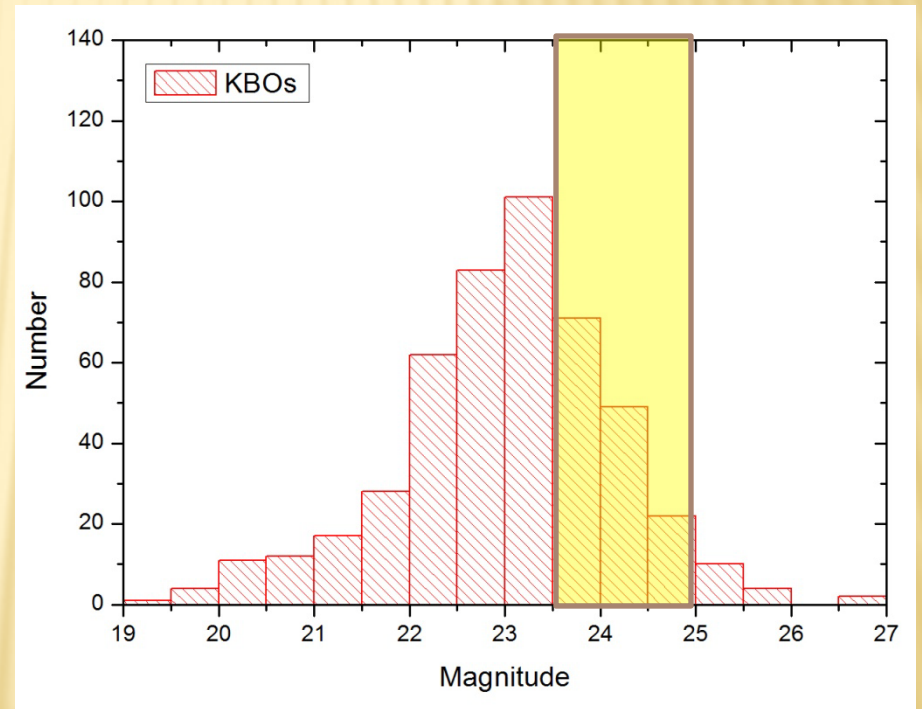
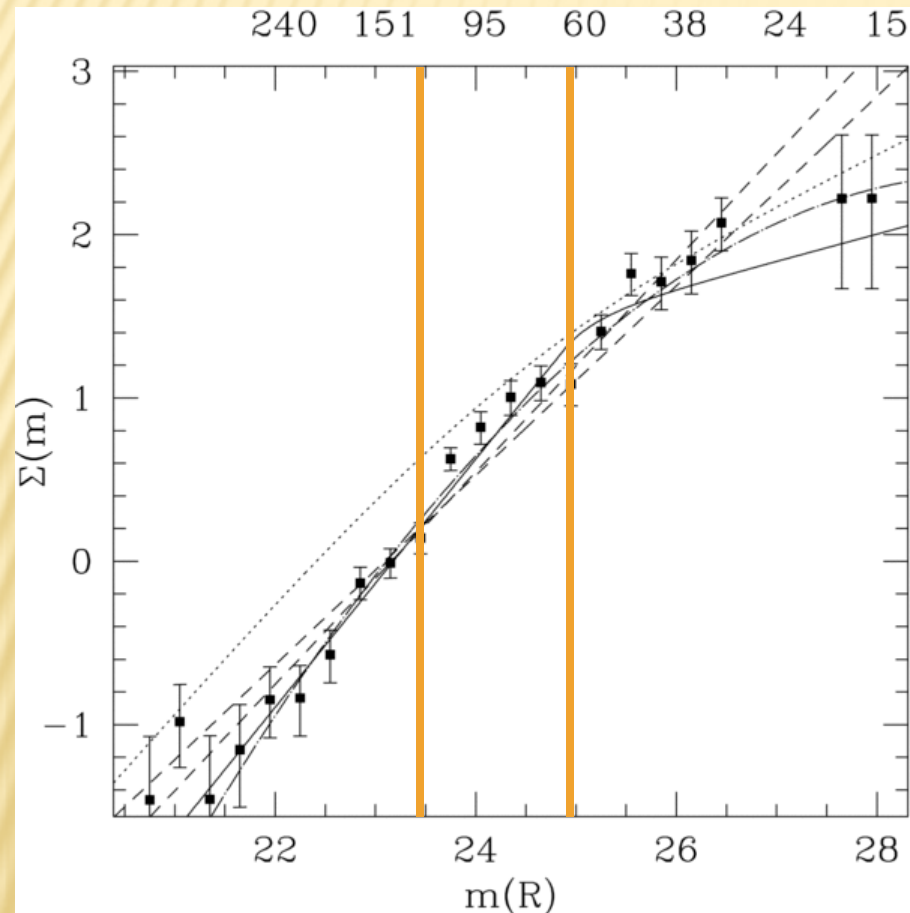
# TWOTINOS

- ✘ The spatial distribution of Kuiper Belt objects (KBOs) in 2:1 exterior resonance with Neptune constrains the planetary migration history. Numerical simulations demonstrate that fast planetary migration (time scale  $< 10^7$  yr) would generate a larger population of KBOs trailing rather than leading Neptune in orbital longitude. (Murray-Clay & Chiang 2005).



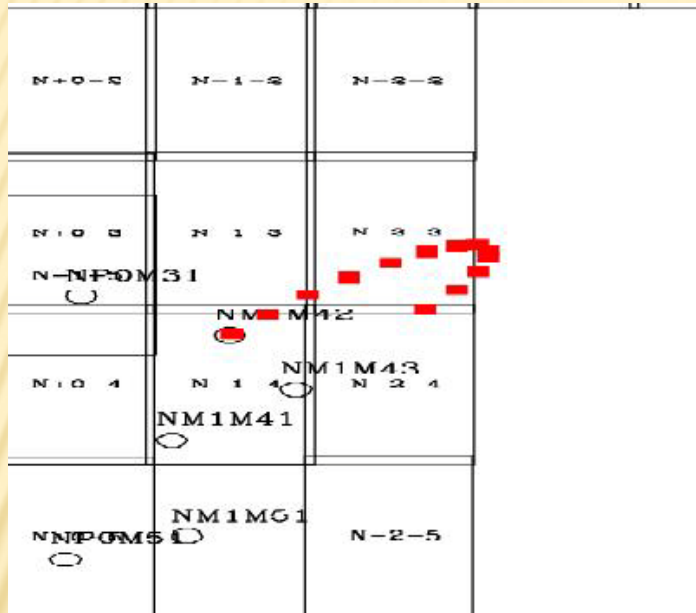


# THE MAG DISTRIBUTION OF TNOS



Fraser and Kavelaars (2009)

# RESULTS OF NGVS KBOS



Linking system : Pan-STARRS MOPS  
(Moving Object Processing System)

24 KBOs found on NGVS 2009A.

Predictions of KBOs positions for each 14 days

2009

2010

NGVS 2009A

CFHT 2010A Follow-up

NGVS 2010A

2010B Follow-up



# FUTURE WORKS

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- ✘ CFHT 2010A proposal is awarded 10.5 hrs of observing time.
- ✘ Follow-up of 2009A NGVS KBOs by CFHT , Gemini, or other telescope.
- ✘ More KBOs found and identified by NGVS on CFHT 2010A ~ 2012A.
- ✘ Debias of survey results, building Model to fit distribution of twotinos KBO.