RED DE INFRAESTRUCTURAS DE ASTRONOMIA

gaia

Spanish ICTS contribution to ESA's Gaia mission, Madrid, 21st March 2012

UV-Visible spectra of primitive asteroids: support observations for the Gaia mission

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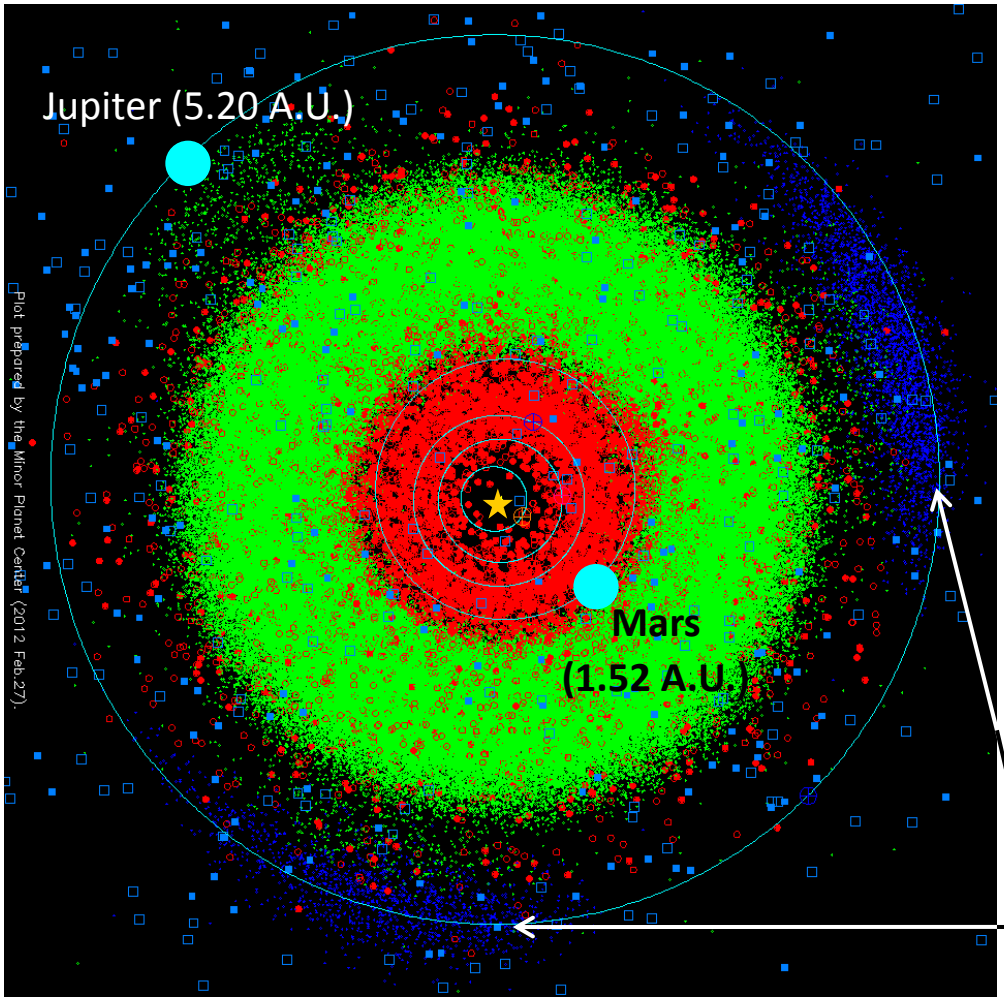
CSIC
I·A·A

Introduction



Near-Earth Asteroids (NEAs)

$q \leq 1.3$ A.U. and $Q \geq 0.98$ A.U.

Mars Crossers

$1.30 < q < 1.66$ A.U.

Main Belt Asteroids (MBs)

[1.52 - 5.20] A.U.

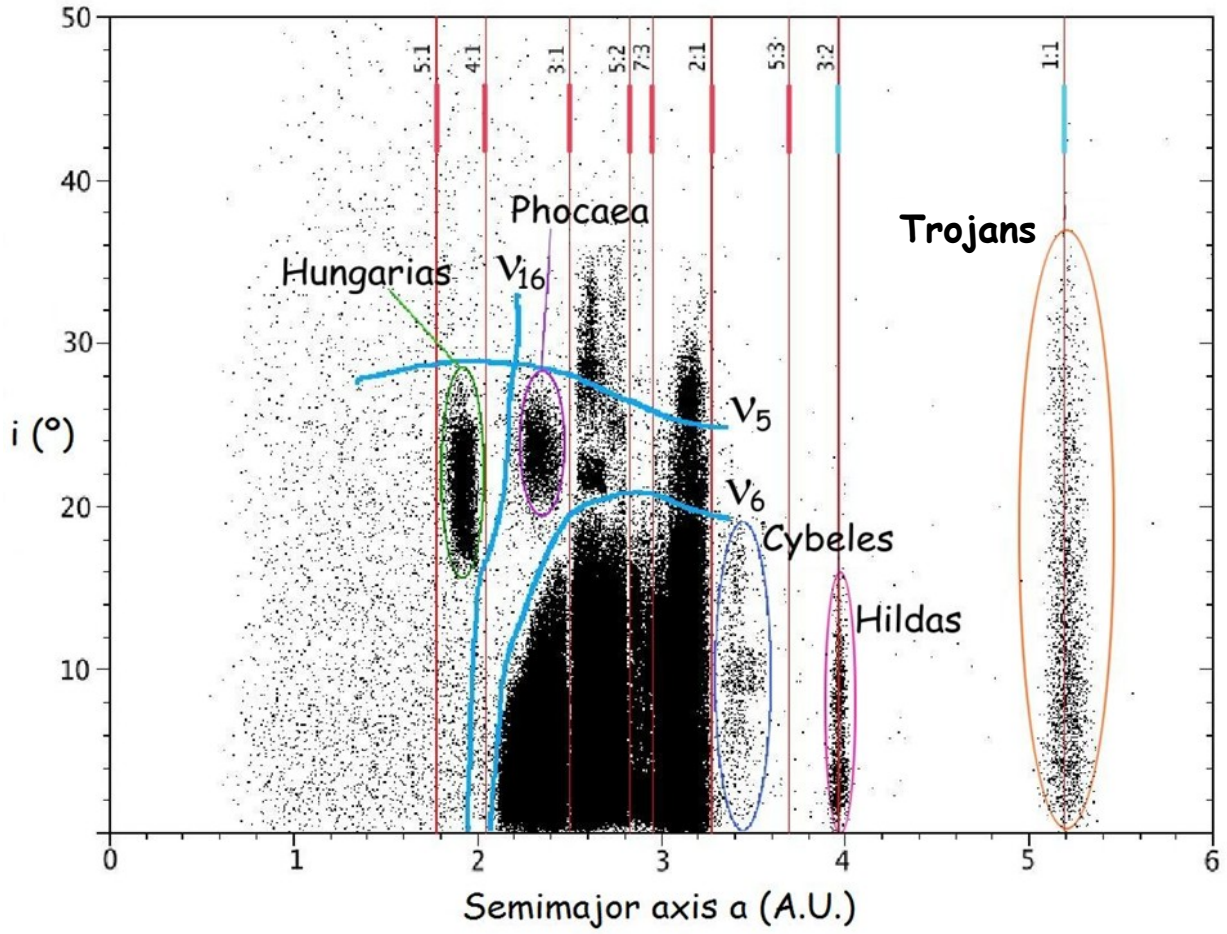
Inner -- [2.06 - 2.50] A.U.
Central -- [2.50 - 3.28] A.U.
Outer -- [3.28 - 5.20] A.U.

Jupiter Trojan asteroids

Lagrange points L4 and L5

Introduction

Main asteroid belt: objects not uniformly distributed



Mean motion resonance 3:1
Secular resonance υ_6

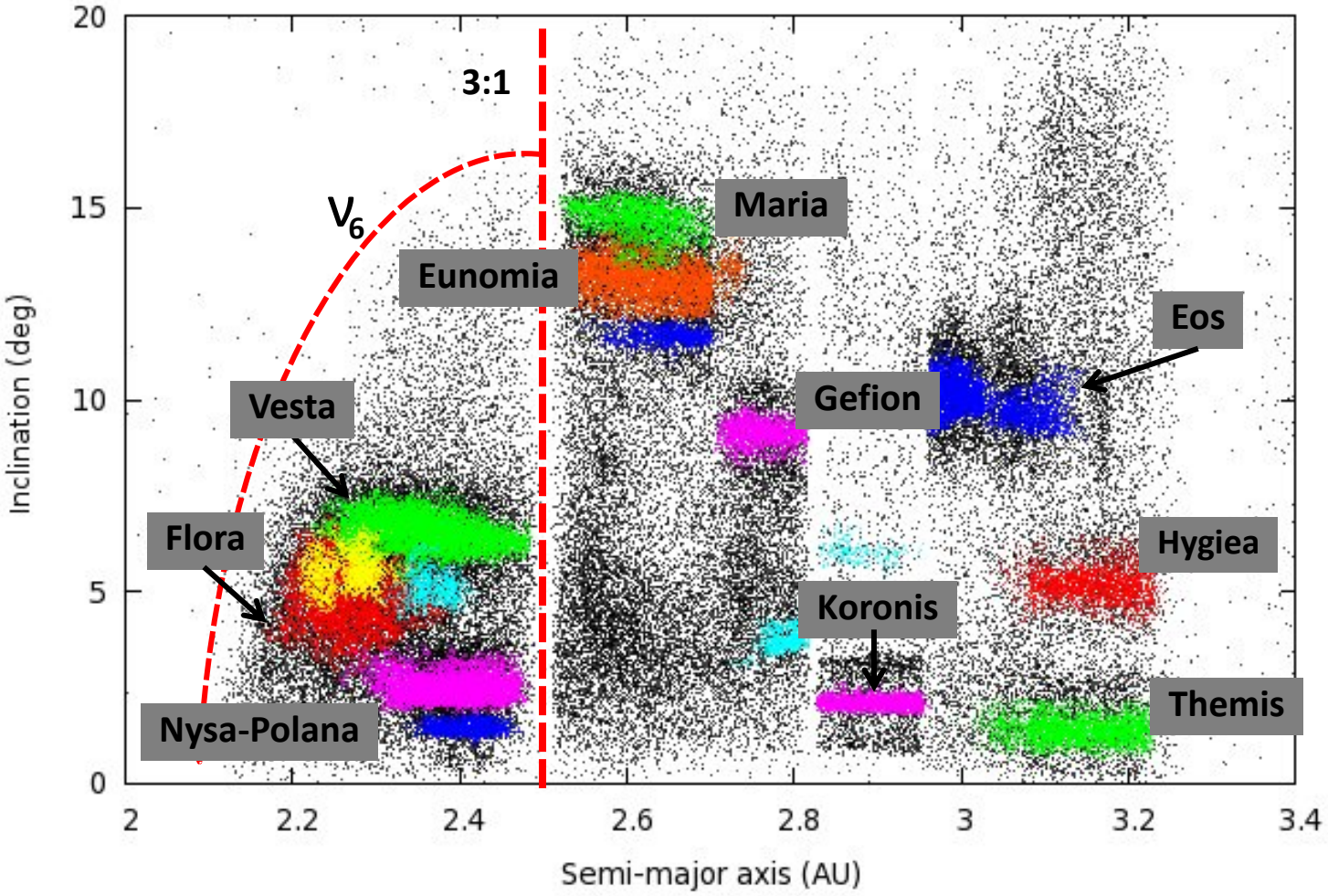
Main transport routes to deliver MB asteroids to near-Earth orbits (~ 61%)

(Bottke et al. 2002)

Central belt (~24%)
Outer belt (~8%)
JFCs (~6%)
[dormant/extinct comets]

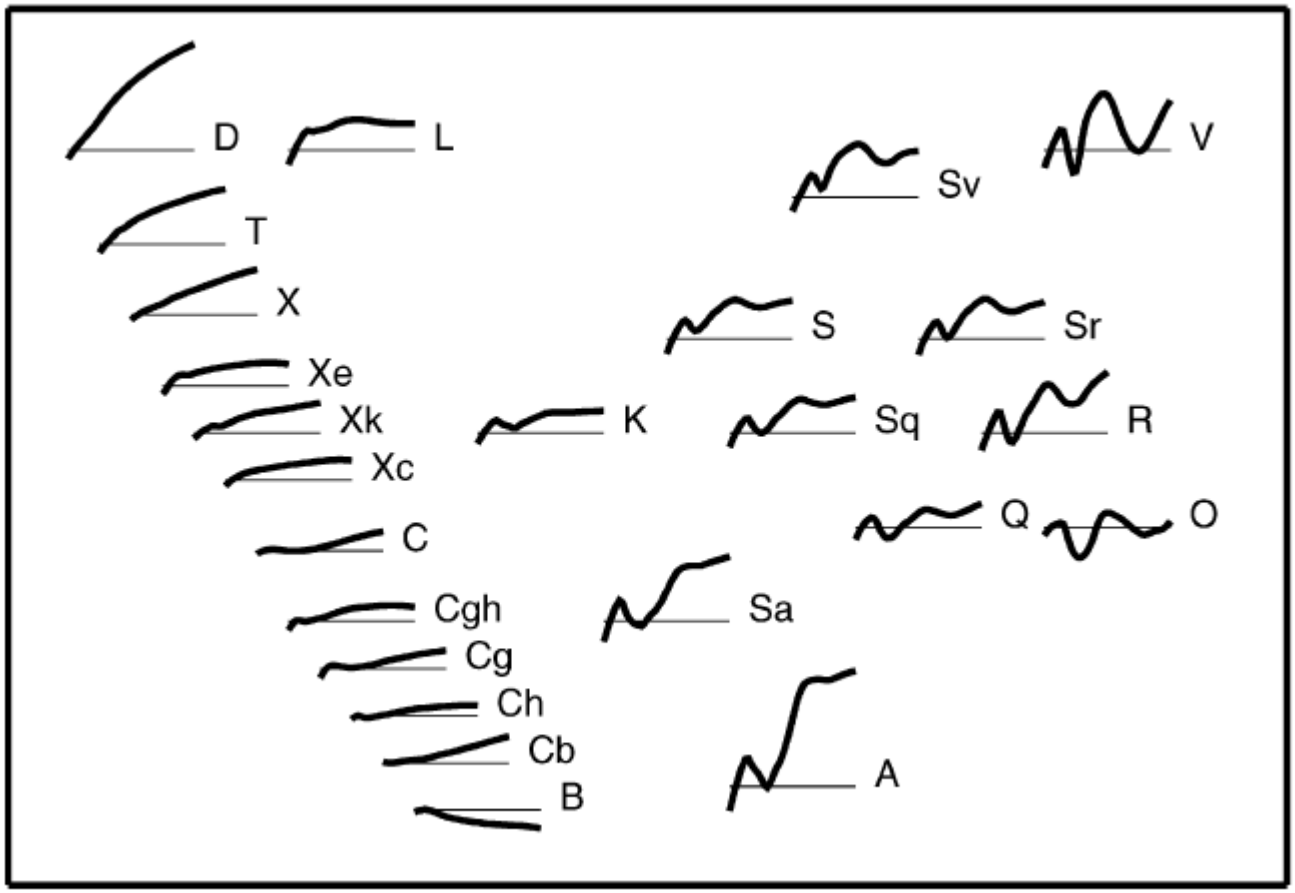
Introduction

Collisions create group of objects that share orbital properties: **families**



Introduction

Taxonomy based on reflectance spectra



(Tholen 1984; Bus & Binzel, 2002; DeMeo et al. 2009)

Introduction

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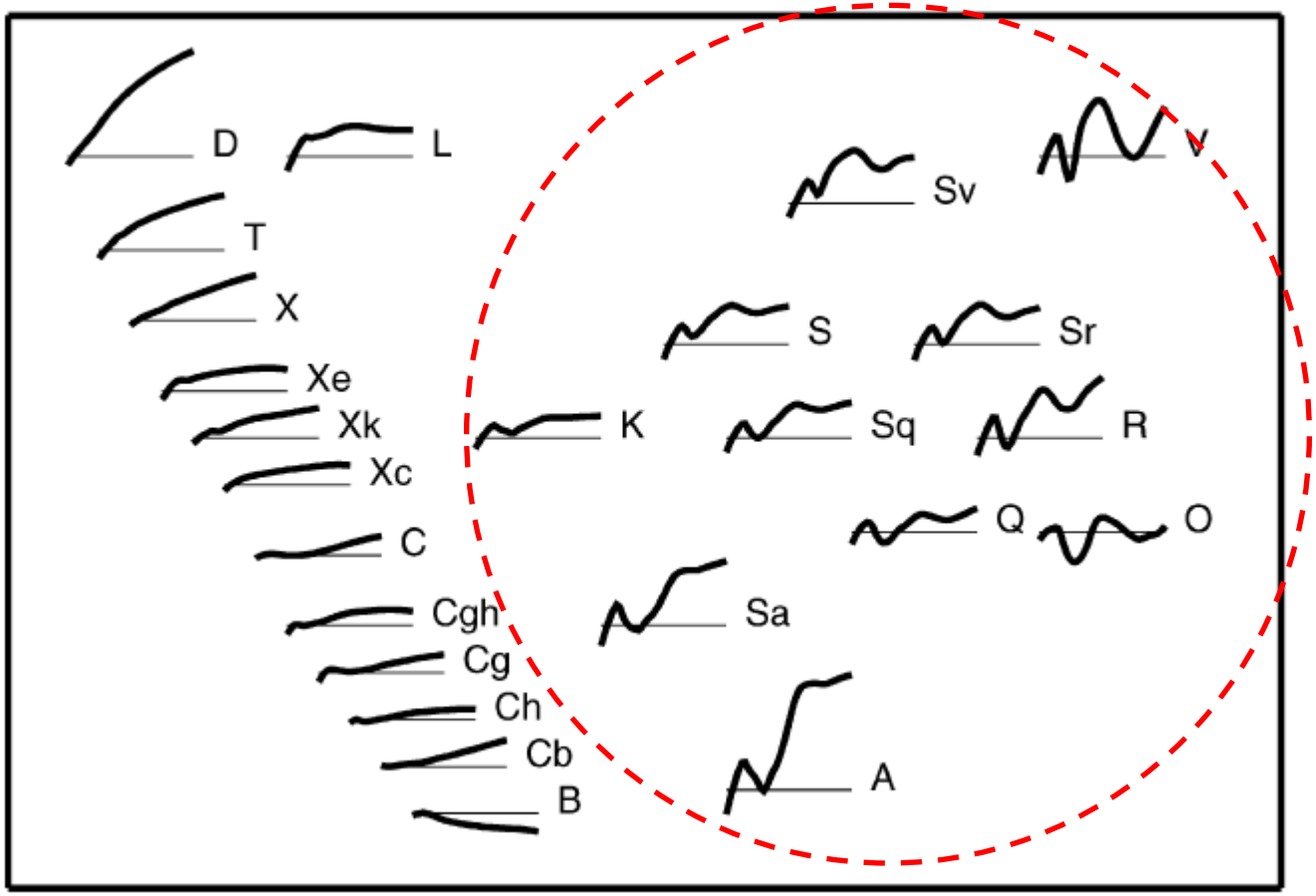


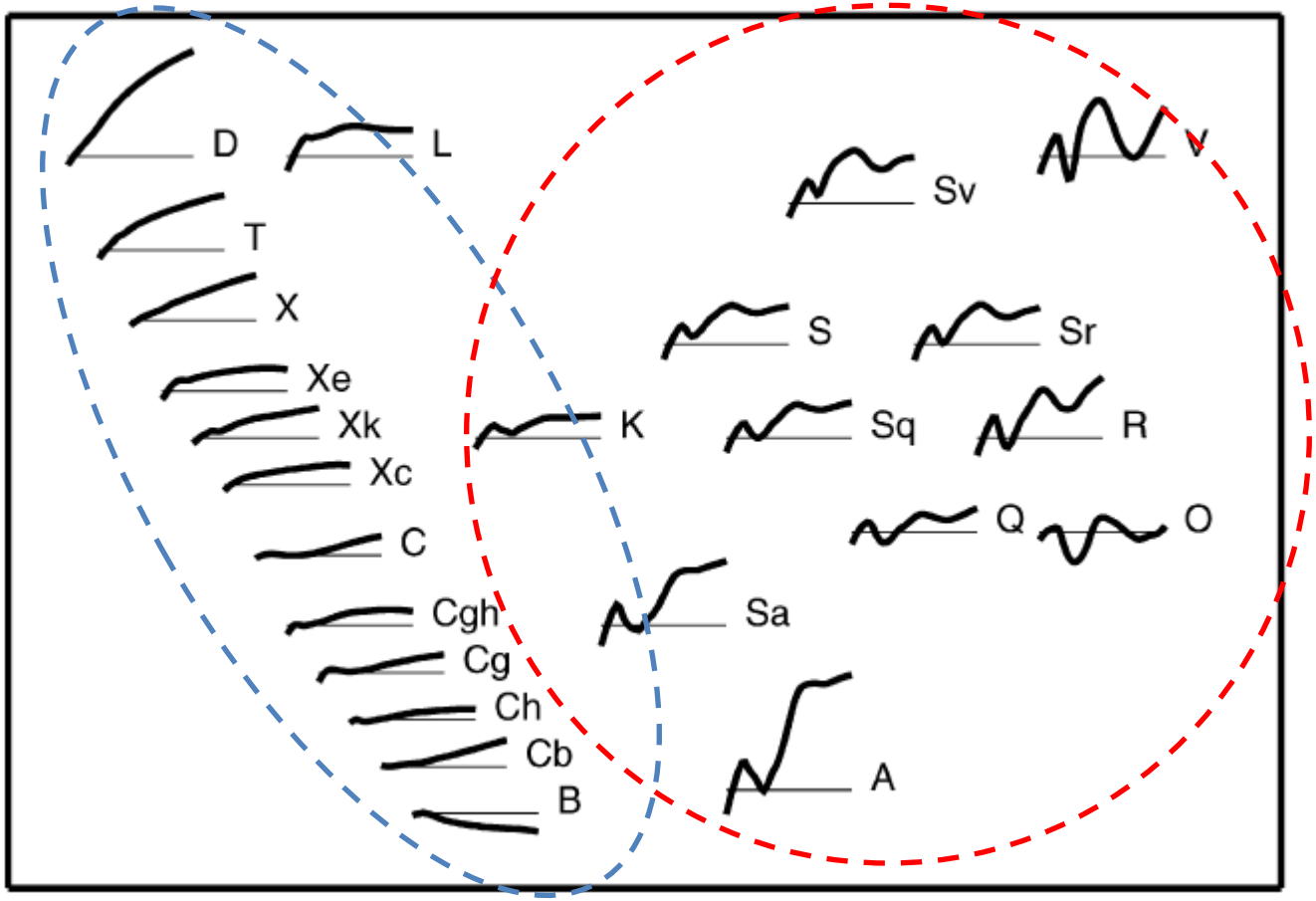
S-complex

- Bright (high albedo)
- Processed materials
- Anhydrous silicates (olivine, pyroxene), metal

(Tholen 1984; Bus & Binzel, 2002; DeMeo et al. 2009)

Introduction

Taxonomy based on reflectance spectra



S-complex

- Bright (high albedo)
- Processed materials
- Anhydrous silicates (olivine, pyroxene), metal

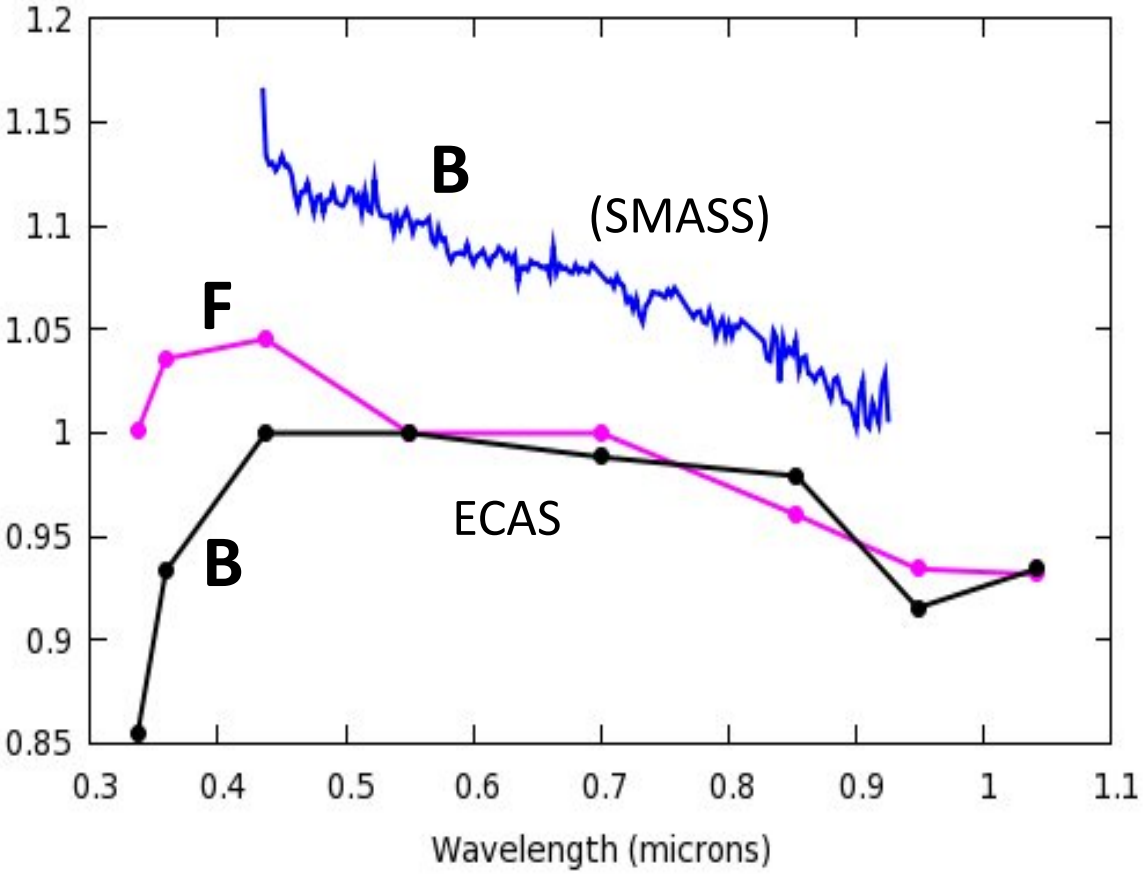
C-complex

- Dark (low albedo)
- Unprocessed materials (primitive)
- Hydrated silicates
- Carbon, opaque phases, organics

(Tholen 1984; Bus & Binzel, 2002; DeMeo et al. 2009)

Introduction

B-type asteroids: characteristic blue (B) slope and UV drop-off



Nature of blue slopes not well understood.

- Grain size
- Carbon/magnetite masking Fe silicate features
- UV drop –off related to Fe-O charge transfer absorptions (Fe^{2+}, Fe^{3+})

Scientific background

B-type NEA (3200) Phaethon comes most likely from B-type (2) Pallas

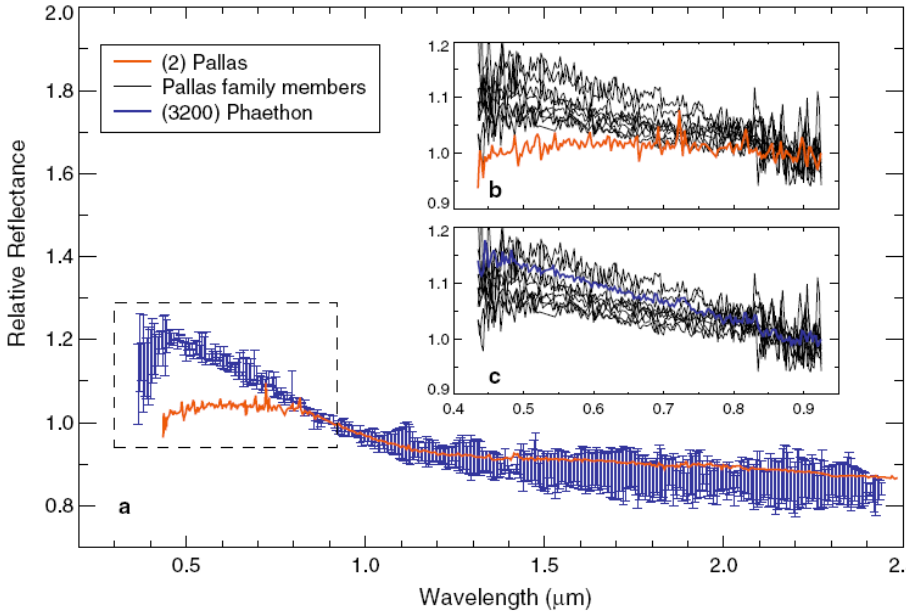
A&A 513, A26 (2010)
DOI: 10.1051/0004-6361/200913609

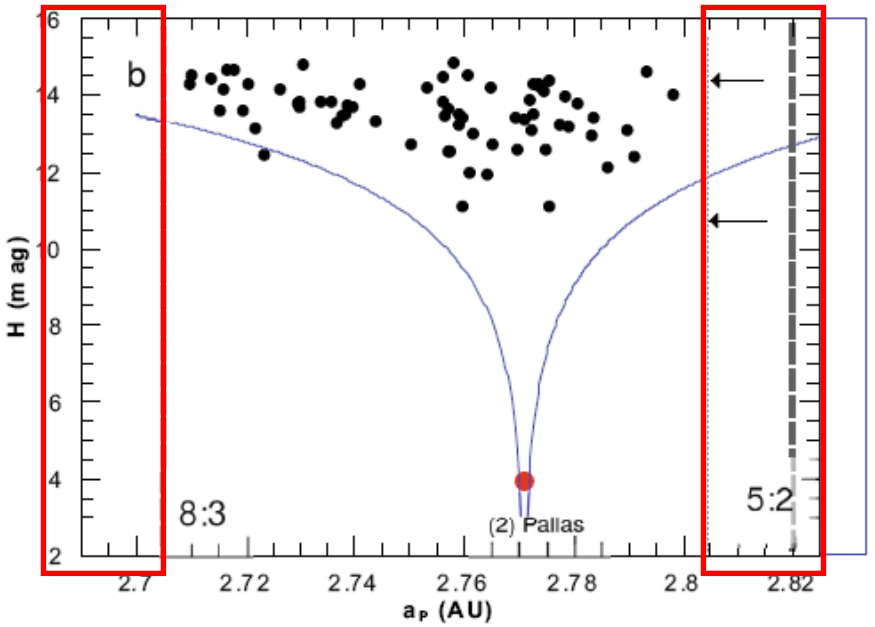
Astronomy & Astrophysics

Origin of the near-Earth asteroid Phaethon and the Geminids meteor shower

J. de León, H. Campins, K. Tsiganis, A. Morbidelli, J. Licandro. **2010**

- Spectral similarities
- Dynamical simulations:
  Orbit integration of fictitious Pallas fragments injected in the resonances (8:3 and 5:2) [100 My]





Scientific background

B-type NEA 1999 RQ_{36}, target of the NASA's OSIRIS-REx space mission

THE ASTROPHYSICAL JOURNAL LETTERS, 721:L53–L57, 2010 September 20 doi:10.1088/2041-8205/721/1/L53

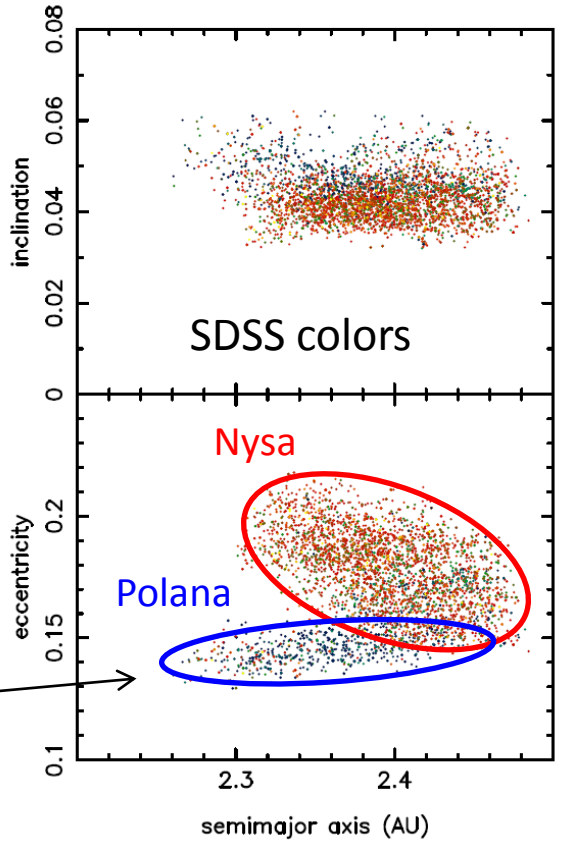
THE ORIGIN OF ASTEROID 101955 (1999 RQ_{36})

H. Campins, A. Morbidelli, K. Tsiganis, J. de León, J. Licandro. **2010**

- Dynamics: most likely source constrained to low inclination orbits between υ_6 and 3:1 resonances [2.15 < a < 2.5 AU]
- Collisional families favored over single objects
- Low albedo (3-6 %) and spectral type

Polana family

The part of the Nysa-Polana complex that extends toward the ν_6 resonance is all Polana family members



Scientific background

Previous results led to a study of B-types in the main belt

Contents lists available at SciVerse ScienceDirect

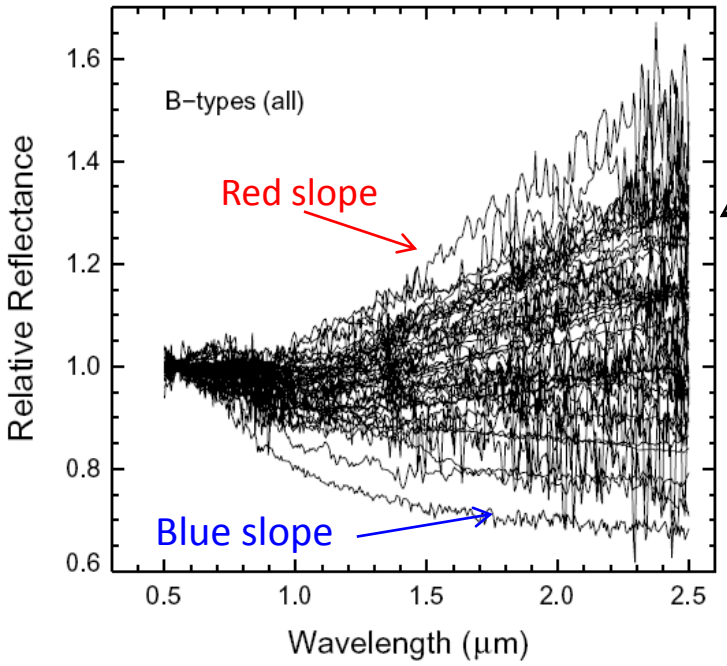
Icarus

journal homepage: www.elsevier.com/locate/icarus

-Near-infrared spectra of 45 asteroids classified as B-types according to their visible spectra

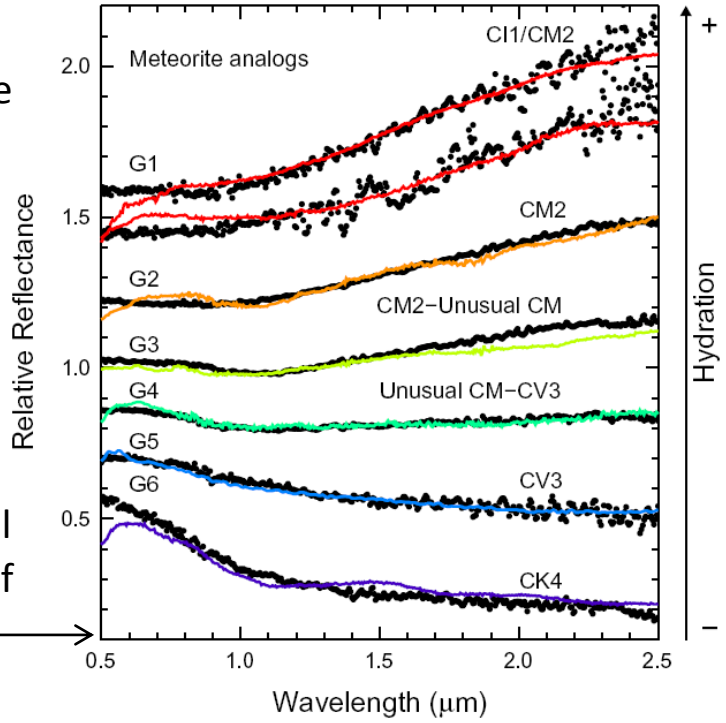
Near-infrared spectroscopic survey of B-type asteroids: Compositional analysis

J. de León, N. Pinilla-Alonso, H. Campins, J. Licandro, G. A. Marzo. **2012**



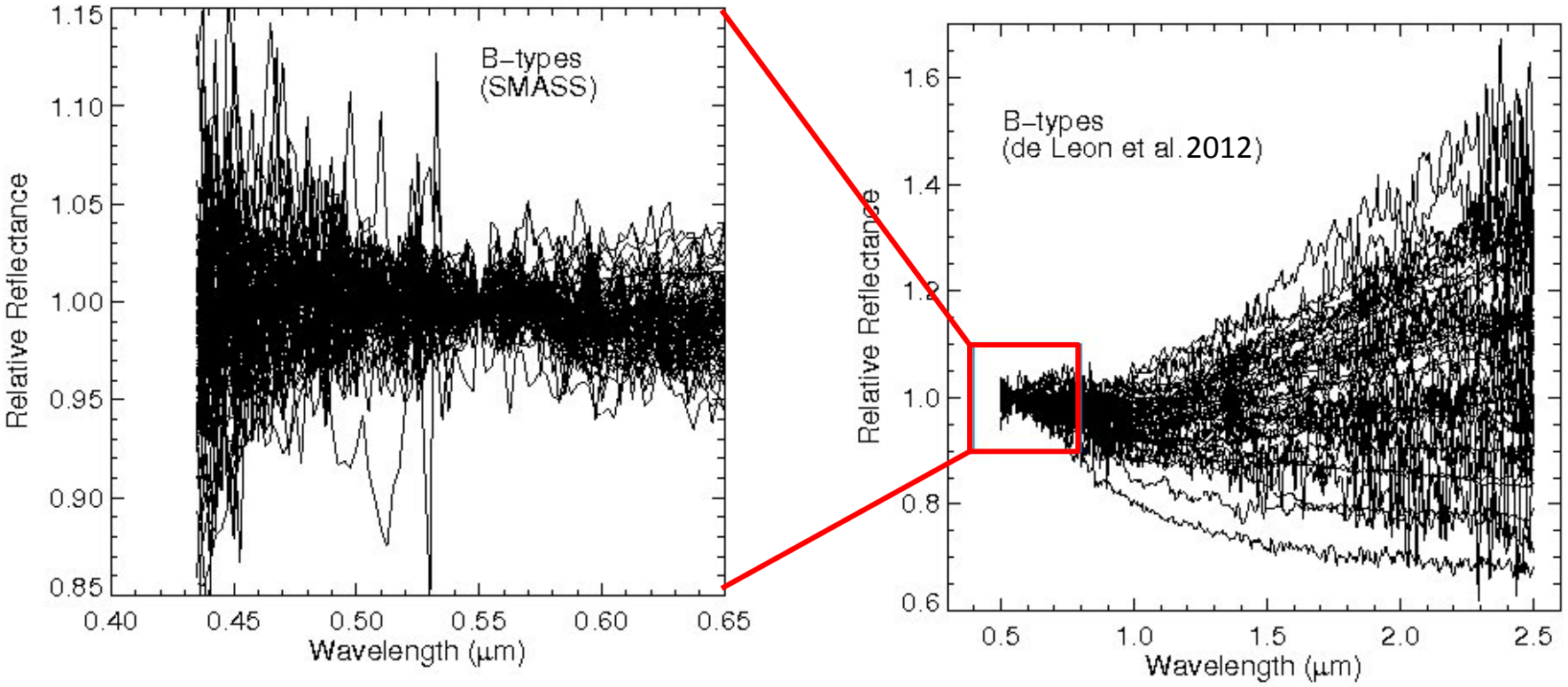
Continuous shape variation

Correlation between spectral slope and level of hydration



Spectroscopic Survey

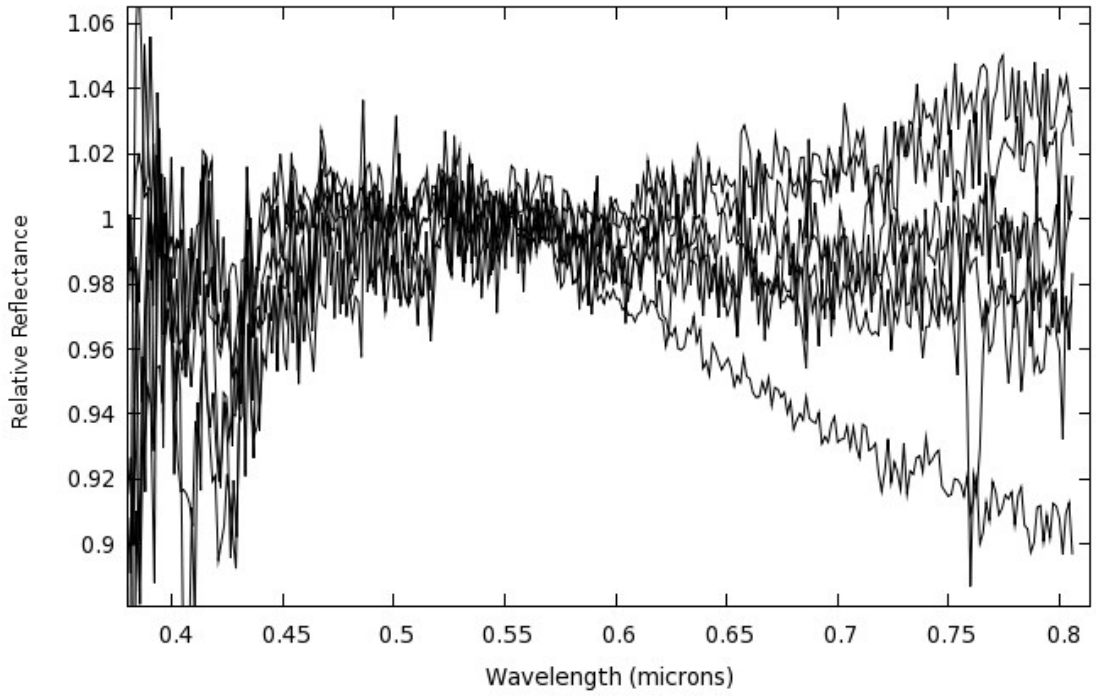
Similar slope variation in the near-UV?



Spectroscopic Survey

Observational proposal at 3.5m TNG using DOLORES (0.35-0.85 µm)

J. de León, N. Pinilla-Alonso, H. Campins, V. Alí-Lagoa,
A. Cellino, M. Delbó, P. Tanga



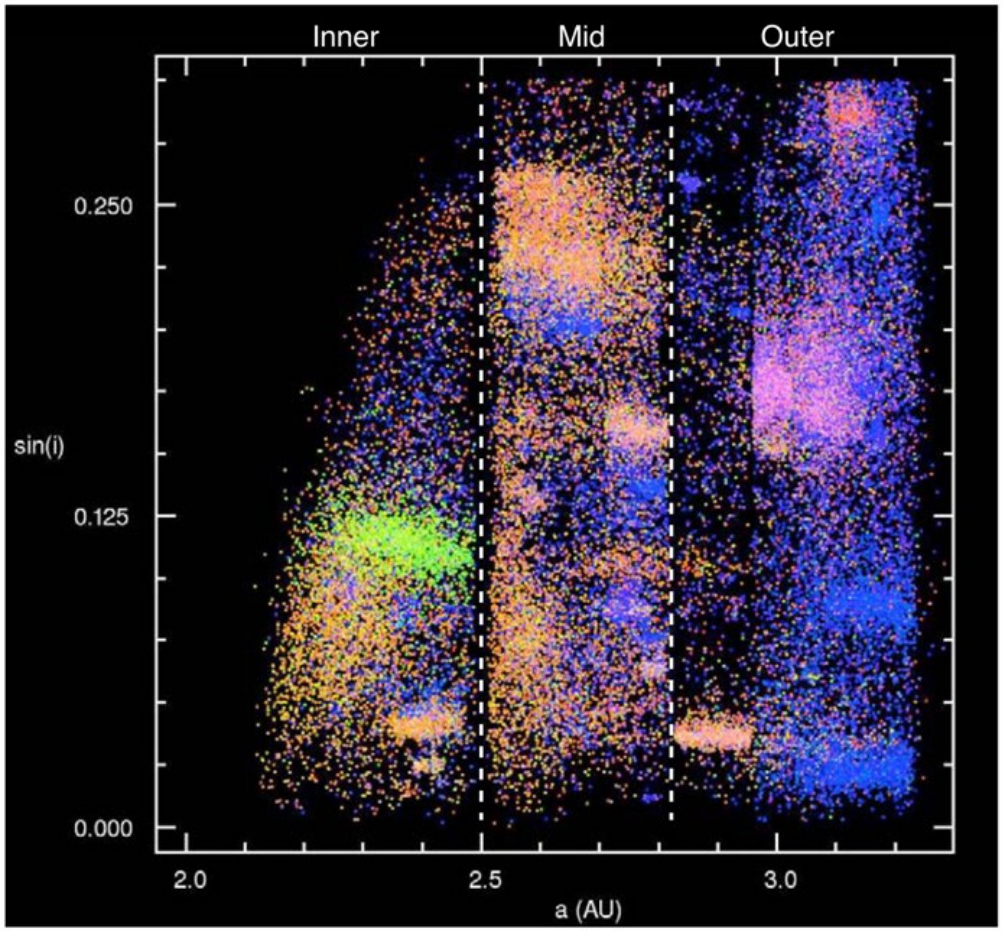
Preliminary results from night 06/02/2012 (7 asteroids).
3 nights (06-09 Feb) were awarded in semester 2012A. More observations have been requested for semester 2012B.

Support for GAIA mission

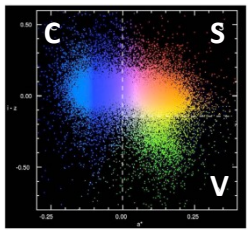
Launched in 2013
Low-res. Spectra (0.35-1.0 µm)
~ 2×10^5 asteroids

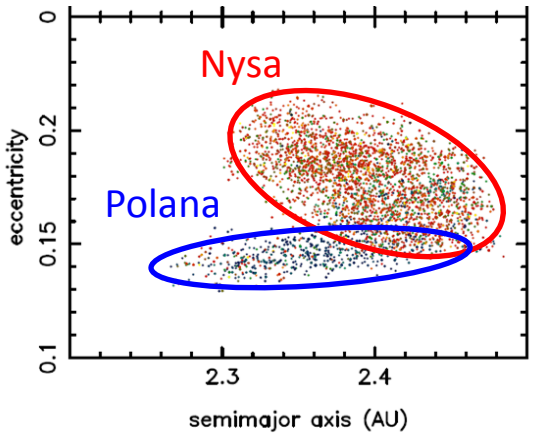
Spectroscopic Survey

SDSS color photometry

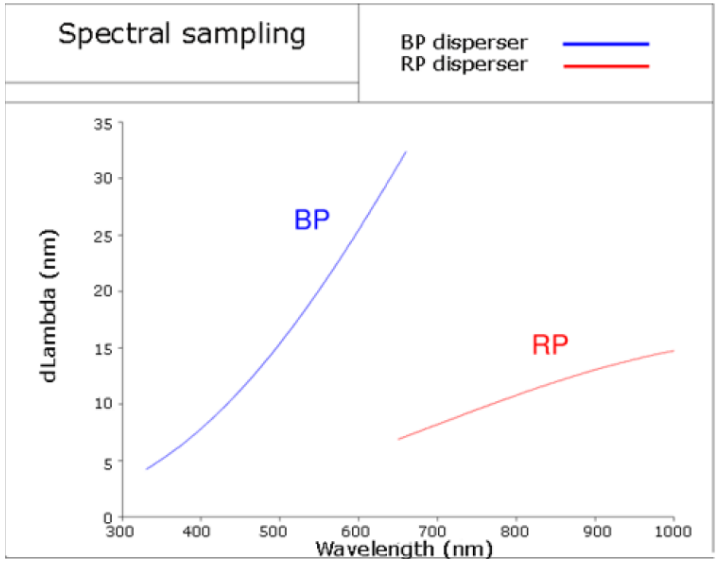


u' (354), g'(477), r' (623), i'(763), z' (913) nm

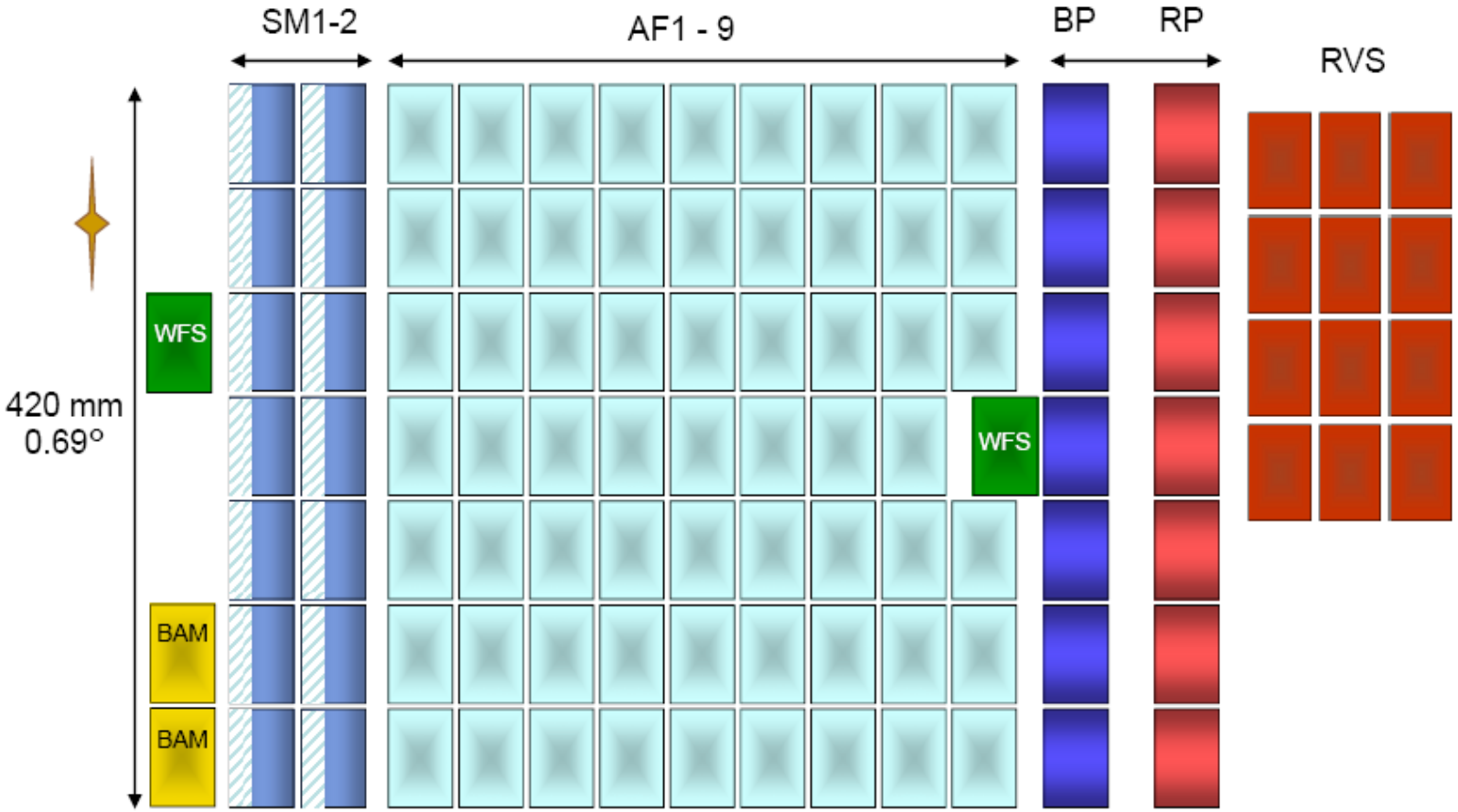




Gaia

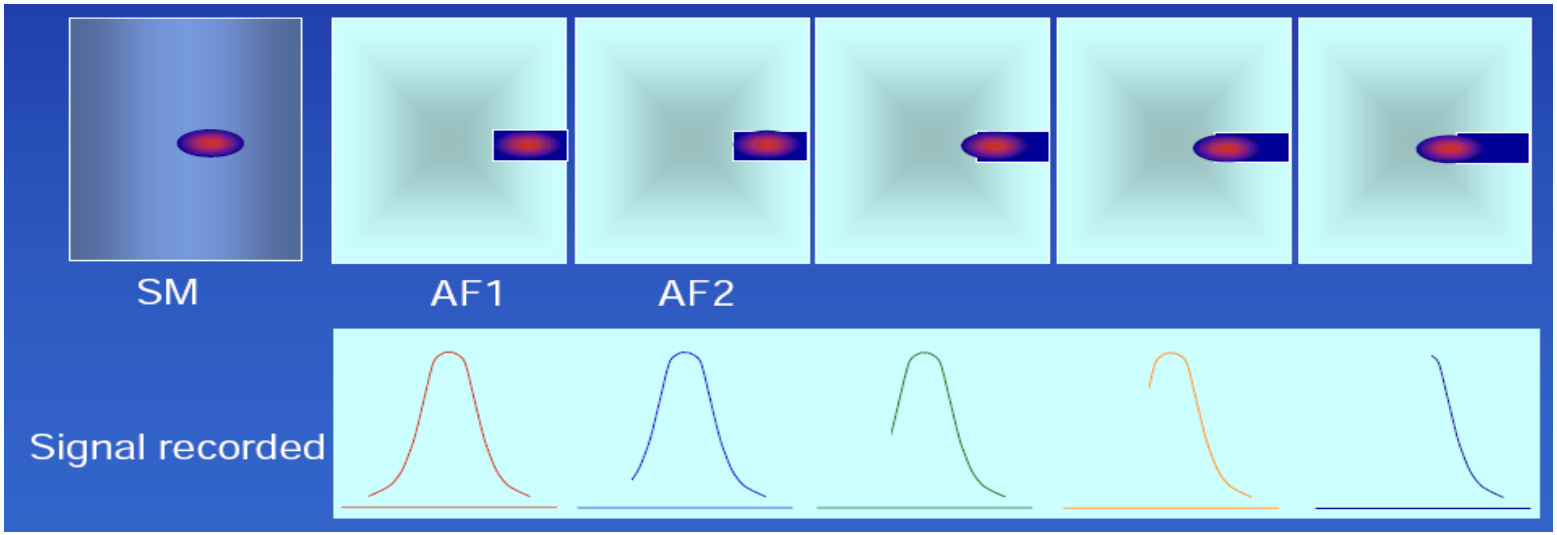


Focal Plane Assembly



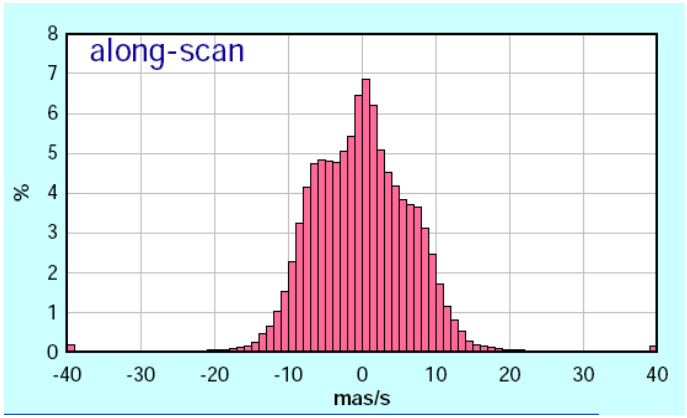
P. Tanga (2011)

Ventanas sobre objetos en movimiento: detección



P. Tanga (2011)

Distribución de velocidades (respecto a las estrellas) en el plano focal



NEAs, MBs --> σ ~ 7 mas/s (AL)

σ ~ 12 mas/s (AC)