Solar system small bodies with WISH

(asteroids, comets, Centaurs and TNOS)

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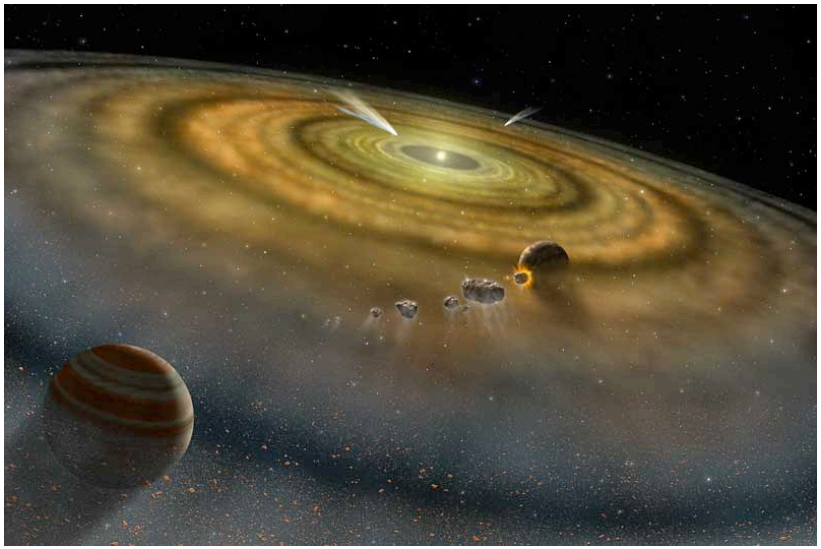
Why solar system small bodies ?

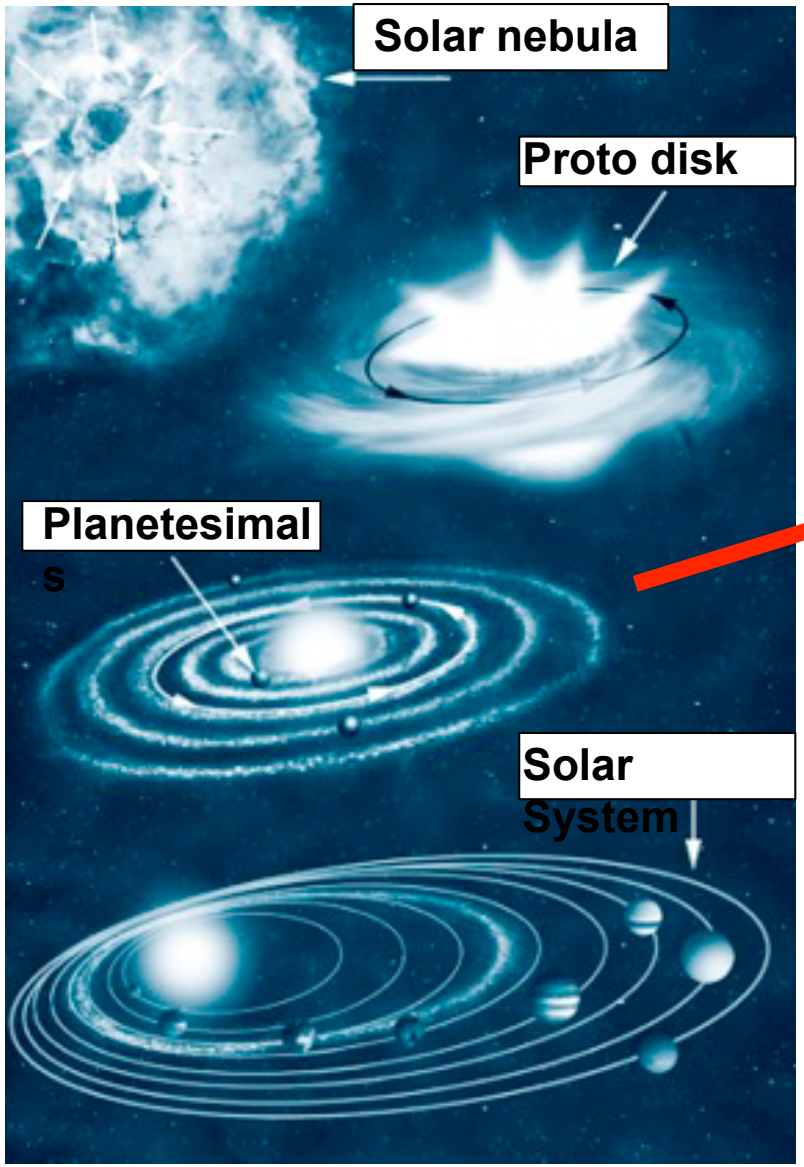
Small bodies (e.g., asteroids, comets, Centaurs and Trans-Neptunian objects) are the most direct remnants of the original building blocks that formed the planets.



They contain a relatively pristine record of the initial conditions that prevailed in our solar nebula some 4.6 Gyr ago.

They provide powerful constraints on planets formation models and processes.

Deciphering the History of the Solar System



Planetesimals:
asteroids
comets
TNOs

tell us about:

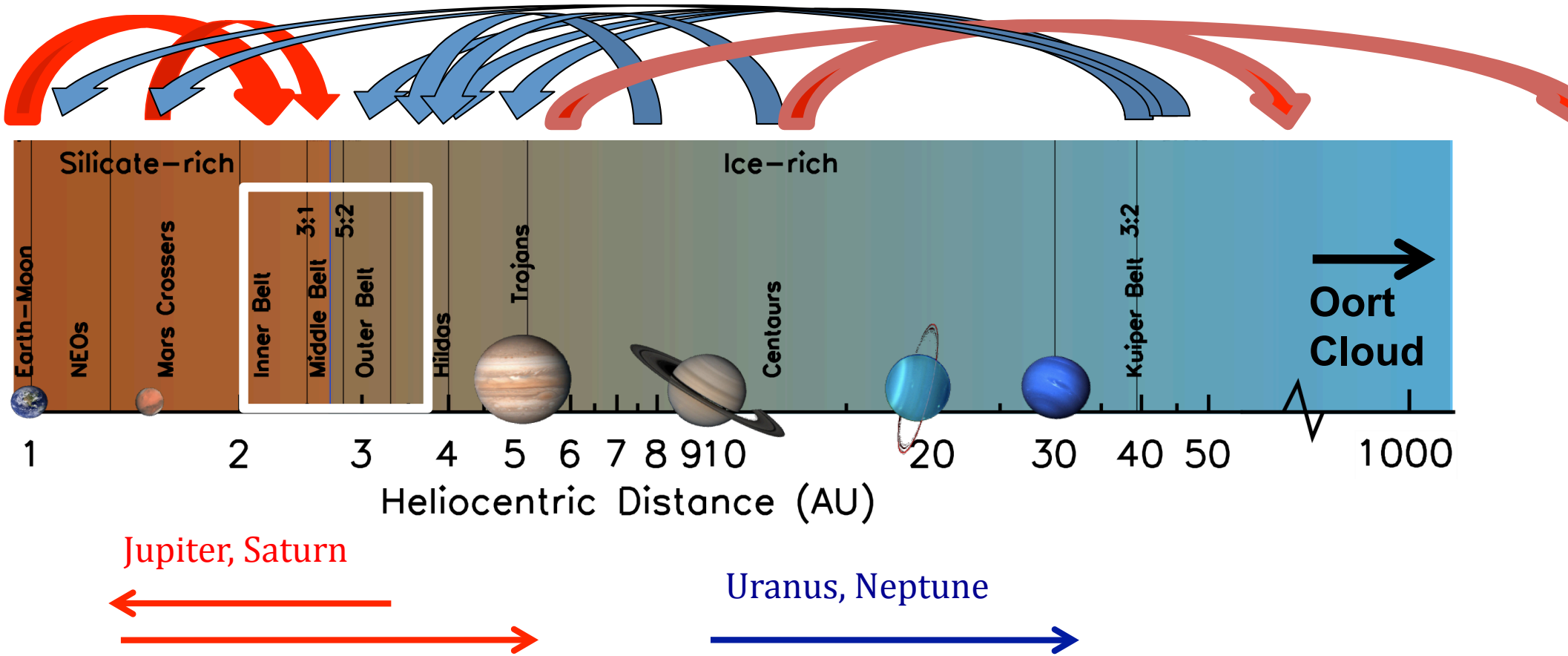
The migration of dust prior to the accretion process

The primordial chemical composition from which planets once accreted

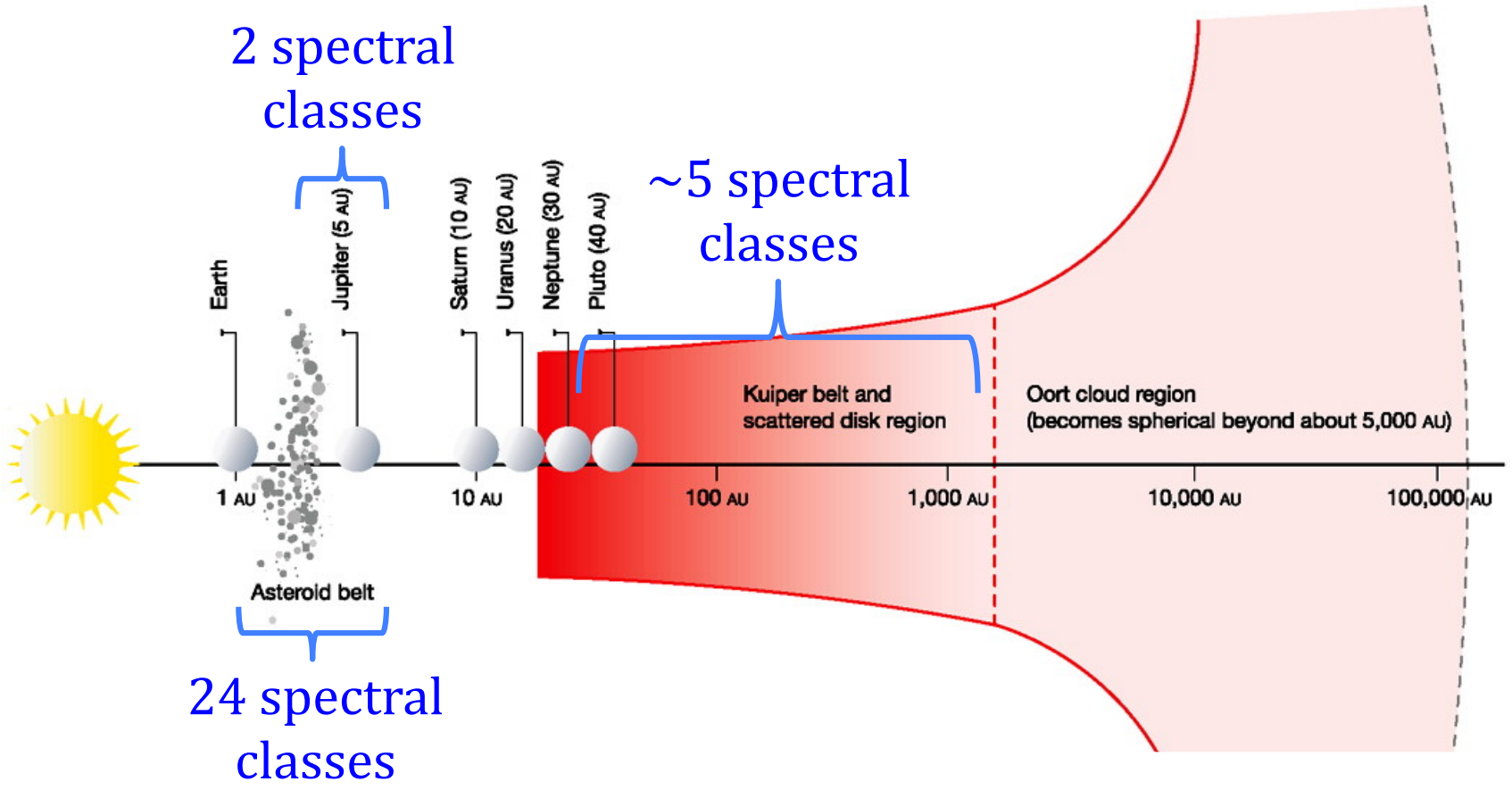
The migration of bodies during the formation and evolution of the Solar System

The migration of bodies during the formation and evolution of the Solar System

Predicted migrations from dynamical simulations



The diversity of asteroids is diagnostic and a consequence of planetary migrations



Asteroids = Condensed version of the primordial Solar System

Key science questions

A large variety of objects with:

- Very different dynamical parameters (<1 AU to >40 AU)
- Very different composition (ice, no ice, blue, red, …)
- Very different physical properties (e.g., size from <1 km to >1000 km)

Do the different populations have a common origin or not?

- How the populations compare and contrast to each other?
- What is the degree of mixing between the different population?

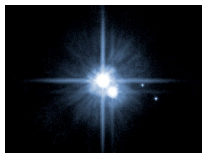
Unique contribution of WISH

Compositional characterization of many members of the different populations.

Scope the different populations, from the inner solar system to the outer solar system:

- Asteroids and main-belt comets

- Comets



- Centaurs and Trans-Neptunian Objects (TNOs)

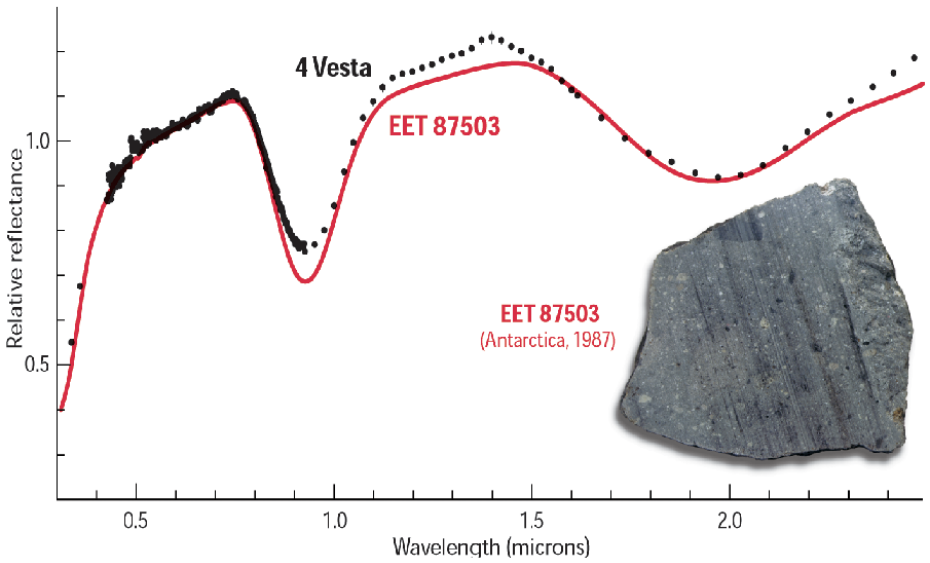
Asteroids and main-belt comets with WISH

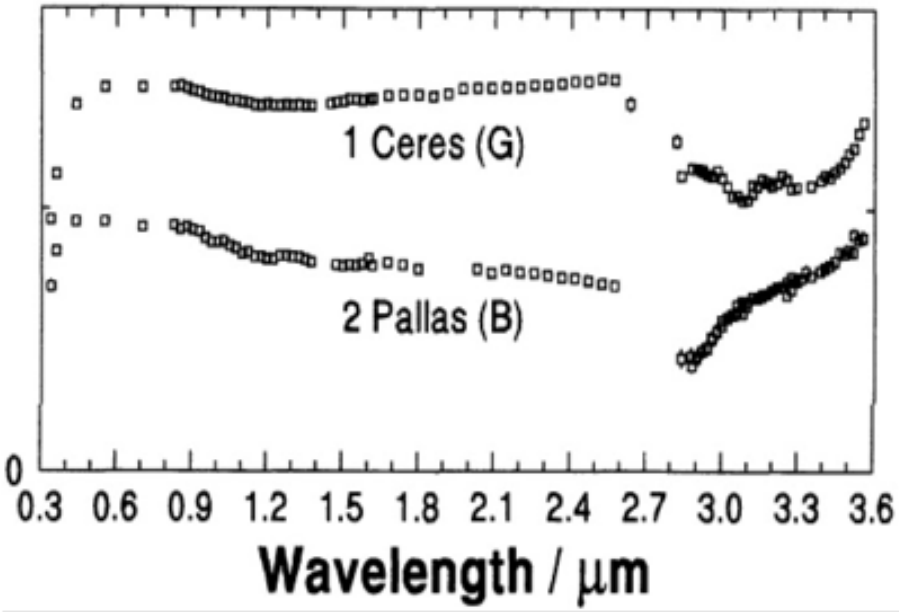
Distinguish silicate-rich bodies from silicate-poor ones

- The link between asteroids and meteorites.

Search for water-rich objects (water ice and/or hydrated minerals)

- A new (expanding) class of objects.

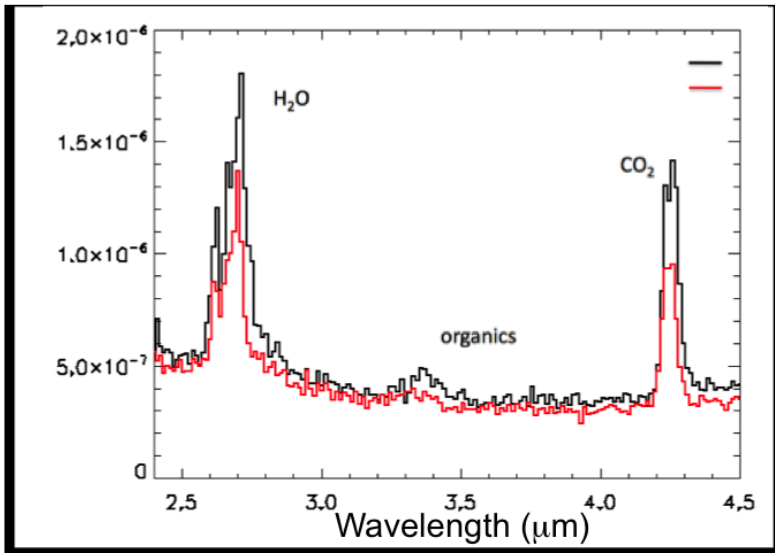




Comets with WISH

Study the composition of volatiles (mainly H_2O, CO_2 and CO)

- Provide insight into the origin of short-period comets (SPC) and long-period comets (LPC).
- Assess to which extend the different families formed in largely overlapping regions or in distinct regions.



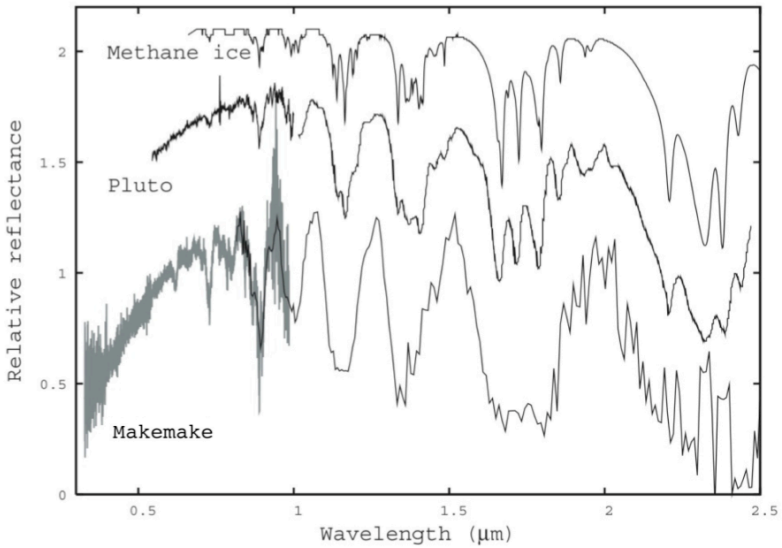
Only 9 comets with H_2O and CO_2 and CO determined

- WISH will enlarge the sample significantly.

Centaurs and TNOs with WISH

Study the surface composition (H_2O, CH_4, NH_3, CO_2, CO, N_2, …)

- Is water ubiquitous in the outer solar system ?
- What is the inventory of organic material ?
- Are there prebiotic material of astrobiology interest ?
- Is the current composition “nature or nurture”



Only 75 TNOs with known composition over >1600 objects

- WISH will enlarge the sample to several hundreds of TNOs.

Conclusions and perspectives

WISH will provide unique observations to determine the composition of all small bodies populations in the Solar system.

For our science case, WISH is an alternative – to some extent - to the JWST.

Even if the solar system science does not drive the instrument design, our scientific community has a strong interest in having a spectroscopic mode on WISH !