CI Dust* Science

*Any solid particle (ice and refractory material)

To understand comets as building blocks of the Solar System we need to understand their evolution. The dust environment is an crucial component of that evolution.

1. *Understanding of the composition and physical properties of the dust particles.*
2. *Link the dust coma to the nucleus to understand the evolution of the surface.*

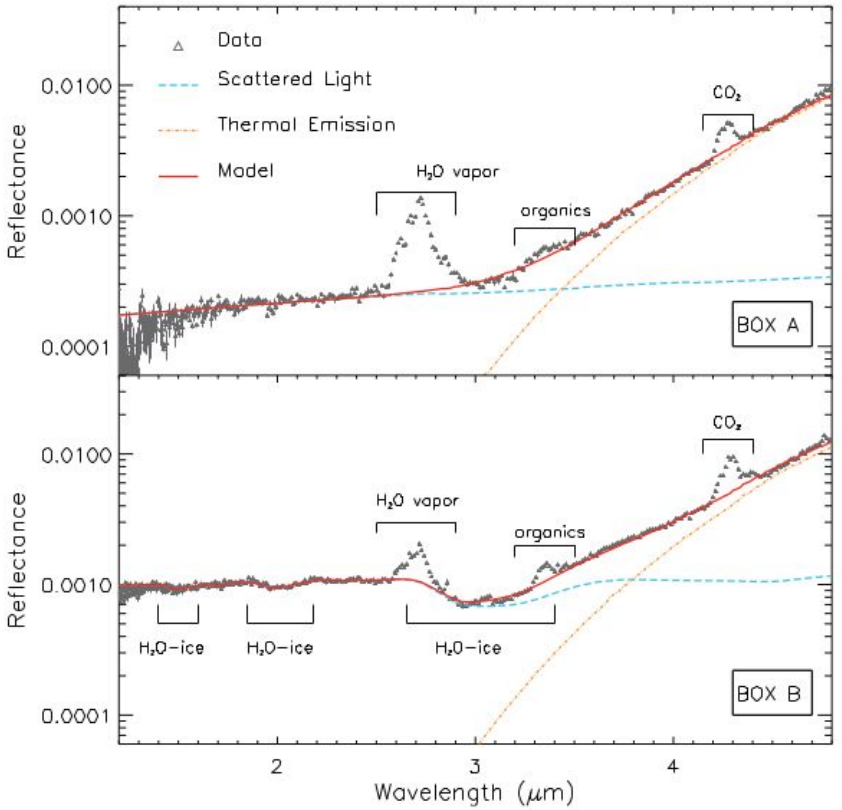
CI gives an important data point to compare a DNC with JFC's
i.e. more primitive vs. evolved.

This requires multi-instrument approach.

1. Composition and physical properties

A. Measurement of the reflectance in the VIS-IR to determine the dust composition and their relative abundances.
E.g. water ice absorption at 1.5 µm, 2.0 µm, 3.0 µm, and 4.5 µm.

B. Measurement of the dust size distribution
   a. directly along the trajectory (1 - 100s µm)
   b. through imaging of resolved large particles (cm +); satellites
   c. through the reflectance and polarimetry of the unresolved dust coma



Protopapa+2014, Icarus

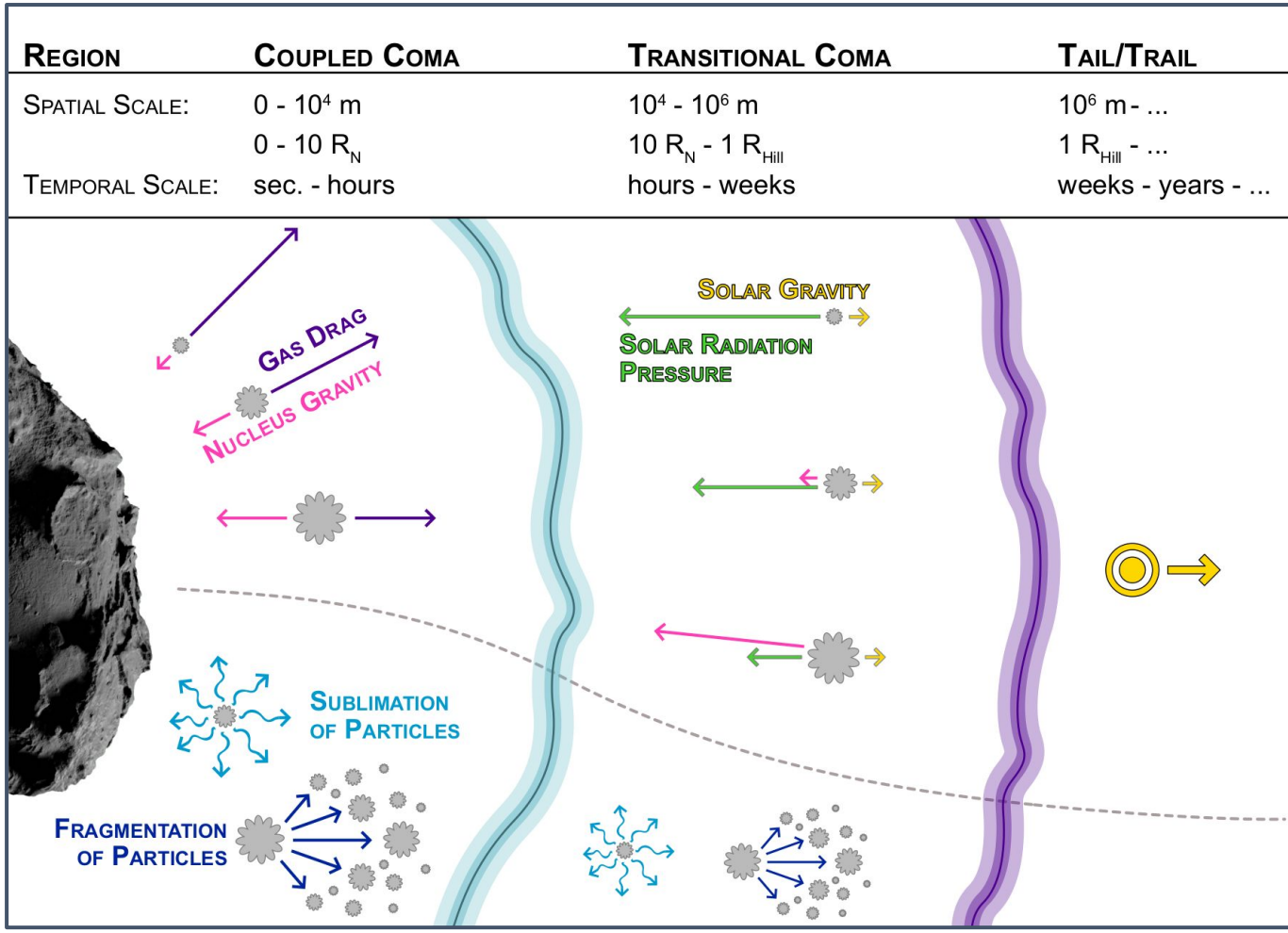
→ which sizes dominate erosion → hints to how activity works → comet evolution

2. Linking the dust coma to the surface

To understand the evolution of cometary nuclei we need to link the in-situ and remote sensing dust coma measurements to the surface
→ **We need to understand the dust dynamics!**

A. Determine the morphology of the dust coma.
B. Determine e.g. the radial brightness to understand acceleration, sublimation, fragmentation, …

→ determine the dust loss…



Marschall+2020, SSR

Global view of cometary activity

There is no “dust science” without “gas science“,
and
no “gas science” without “dust science“.

Think of

Hartley 2 with its significant extended water source from icy grains.

The filamentary structure of 67P’s dust coma.

If we degrade the dust science, we degrade the gas science and vice versa.

Ranking

		Derived category	Derived category "dust researchers"
R1-C-40	Comet Interceptor shall determine the large-scale dust coma activity, morphology and any variability therein.	I	I
R1-C-55	Comet Interceptor shall determine the existence (or not) of local dust structures in the coma.	I	II
R1-C-60	Comet Interceptor shall measure the mass and fluence of dust in the range 1-200 μm.	I	I
R1-C-65	Comet Interceptor shall search for the existence of, and if found characterise, dust particles in the range centimetre – decimetre (chunks and snowballs).	III	II
R1-C-70	Comet Interceptor shall determine the compositional diversity of the dust within the comet coma.	III	II
R1-C-75	Comet Interceptor shall determine coma dust reflectance and polarimetric properties.	III	I