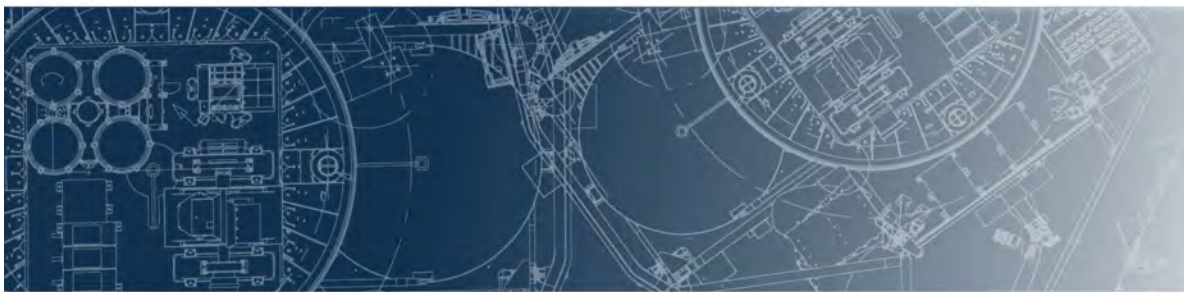


Coordinated studies of meteor aerosols using commercial sub-orbital platforms

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6/25/12



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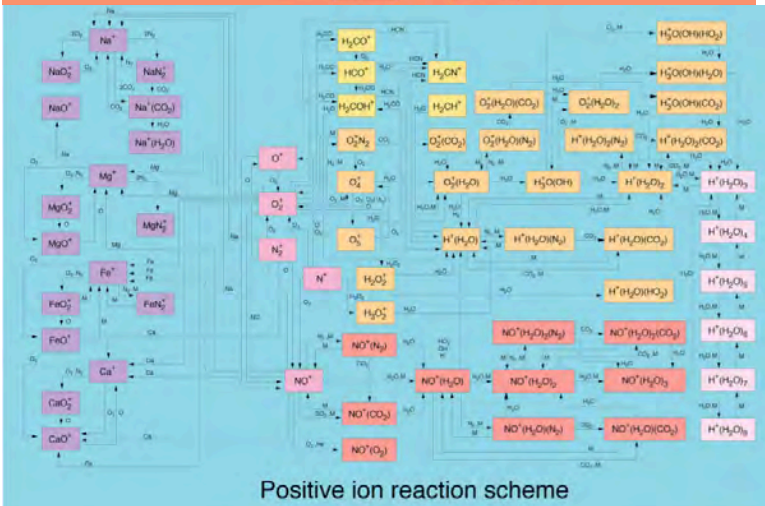
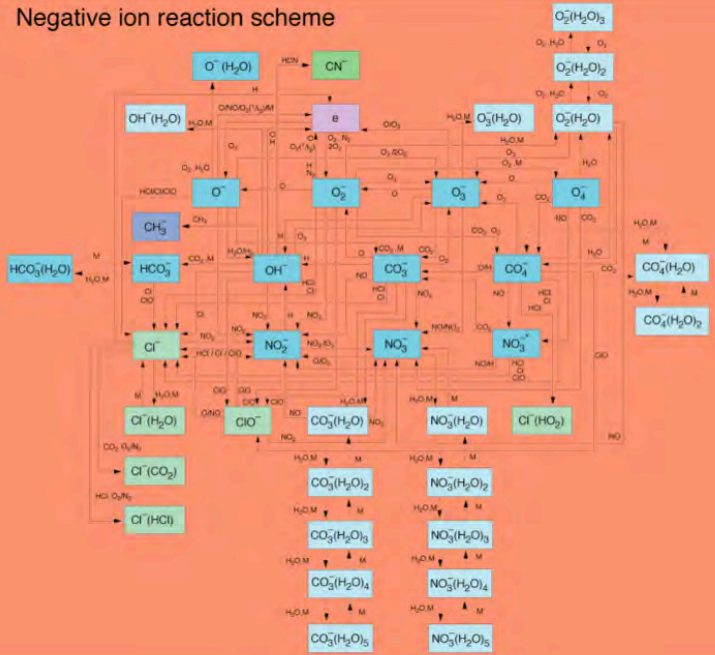
Outline

- Where is the D-region and what's going on there?
- Measurement Opportunities
- Aerogel Payloads
- Conclusions

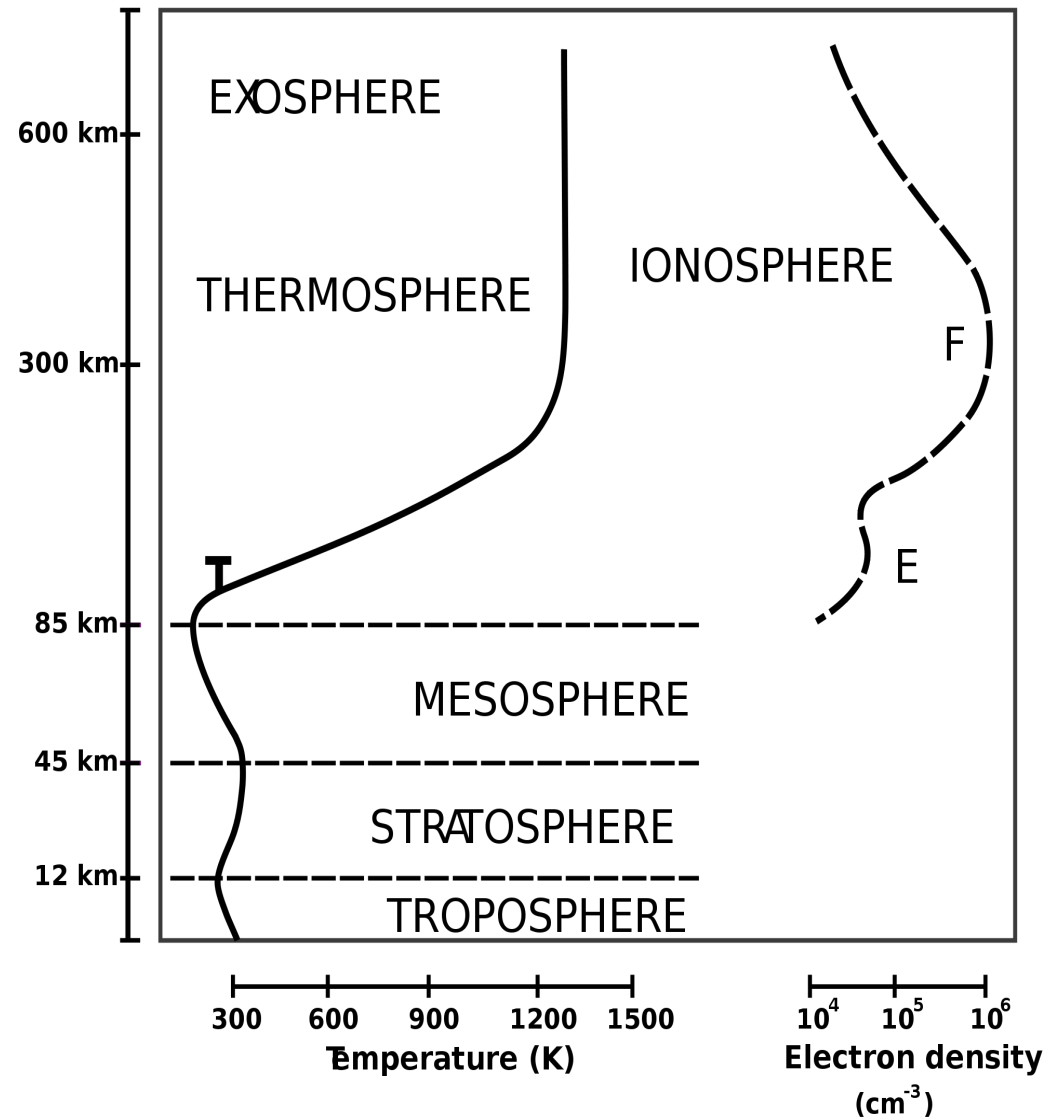
D-Region and MLT...

Complex Chemistry, Dynamics, & Forcing

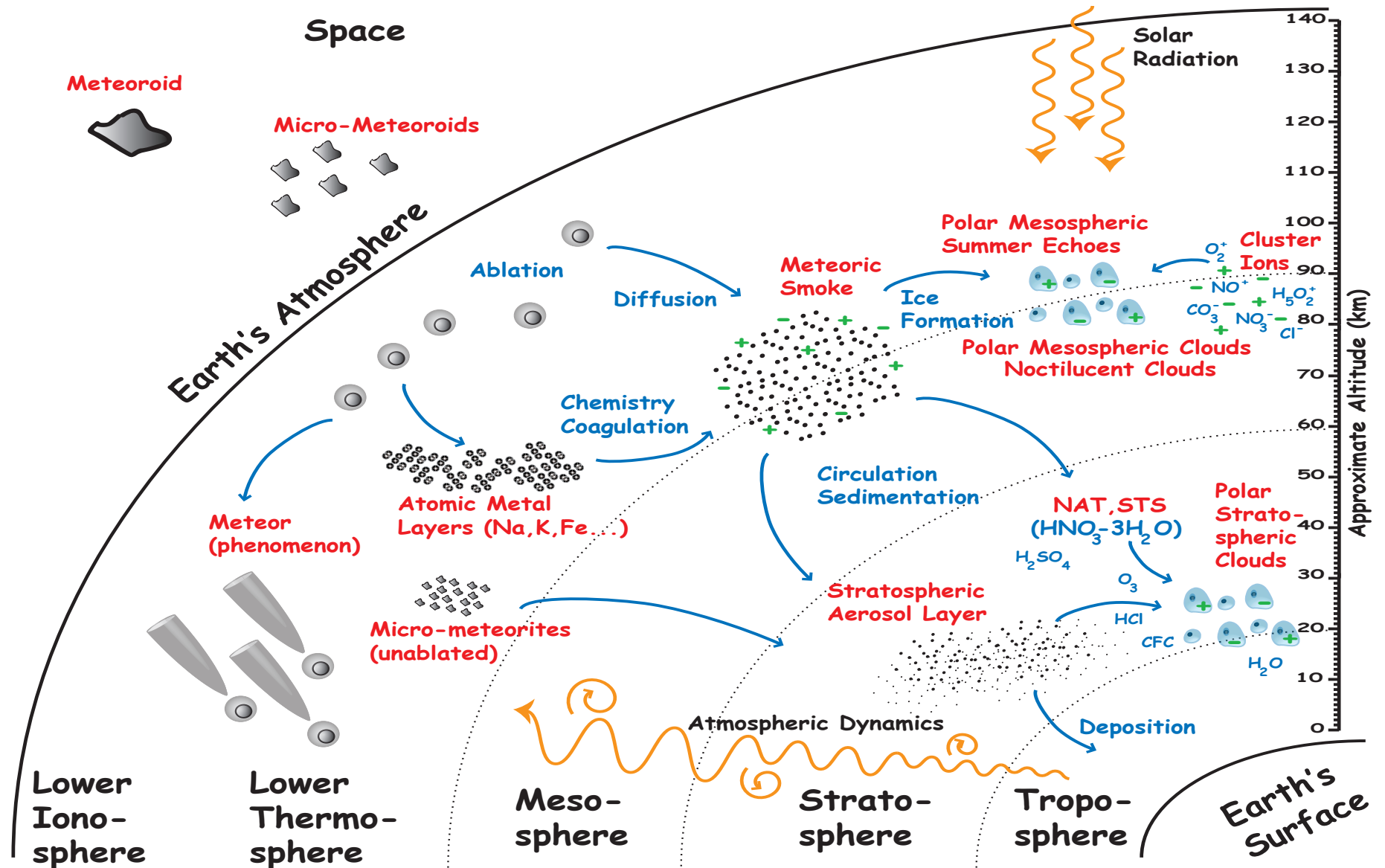
Negative ion reaction scheme



Positive ion reaction scheme



Meteor Related Processes...



Comm. Suborbital Reusable Launch Vehicles (sRLV)

- Multiple providers
- Regular launch schedules
- Internal/external payload accommodation
- \$\$\$ from NASA/ NSF (Others) for instrumentation







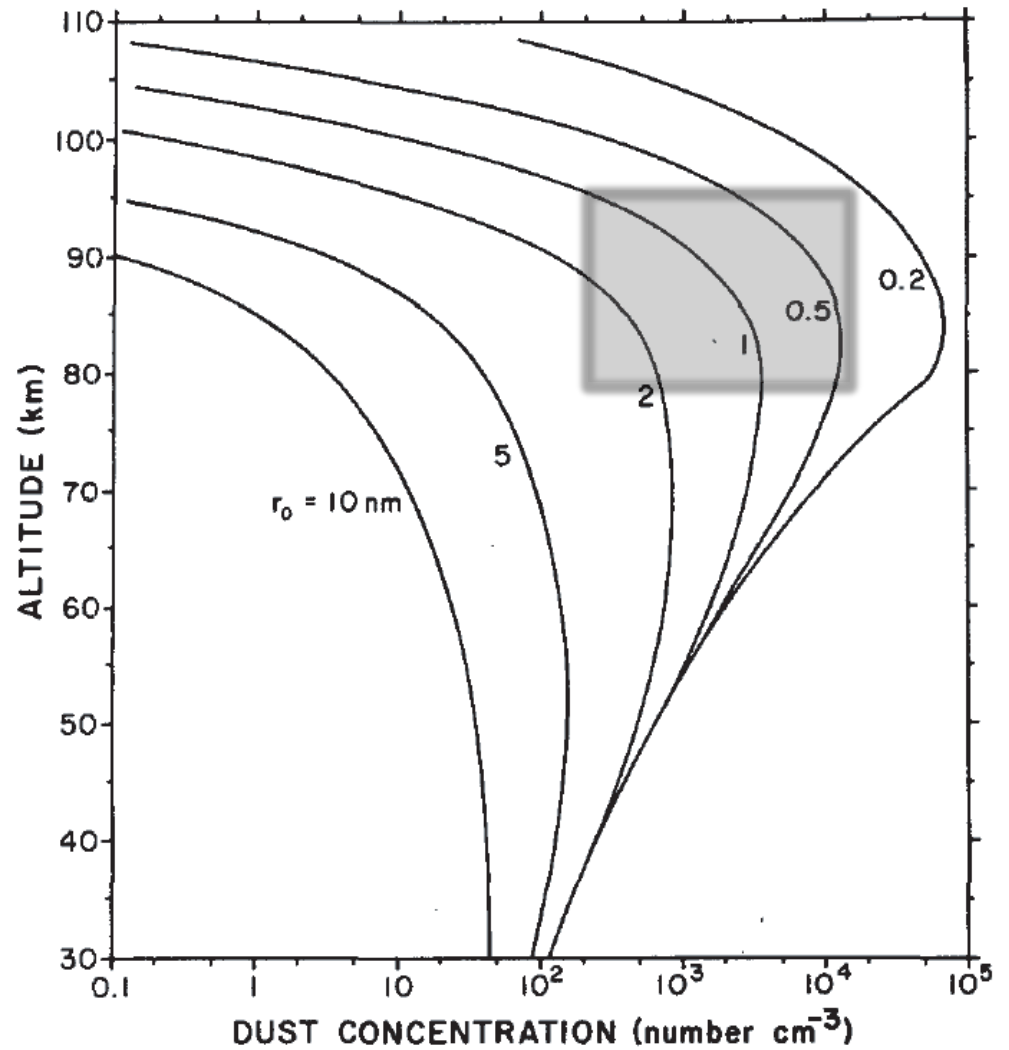
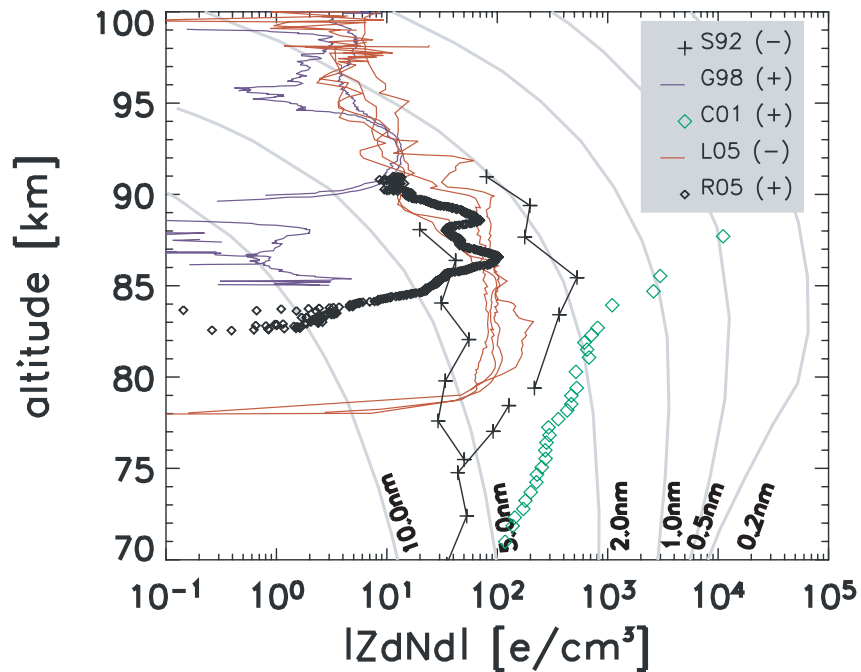
Reusable suborbital launch service providers overview					
Company	Main Vehicle	Year of Test Flights	Launches From	# of Seats	
Armadillo Aerospace	 Hyperion	2014	Spaceport America	2	
Blue Origin	 New Shepard	TBD	West Texas	3+	
Masten Space Systems	 Xaero	2011	Mojave Air and Space Port	0	
UP Aerospace	 SpaceLoft	2006	Spaceport America	0	
Virgin Galactic	 SpaceShipTwo	2010	Spaceport America	8	
XCOR Aerospace	 Lynx	2012	Mojave Air and Space Port	2	

Photo credits: (From top to bottom) Armadillo Aerospace, Blue Origin, Masten Space Systems, UP Aerospace, Virgin Galactic, and XCOR Aerospace.

Science Motivation

- Does our atmosphere contain pre-solar material yet unknown in meteoritic samples?
- What are the physical properties and evolution of the building blocks of terrestrial planets?
- What are the nature and the origin of the organics in primitive bodies and how can they shed light on the origin of molecules necessary for life?

Meteor Dust...Mesospheric Aerosols



Rapp et al., 2007

APL

Hunten et al., 1980

Aerogel

- A “purged” gel, rigid lattice structure
- Si, Al, C, Ti...
- Thermal, electrical, and acoustic insulation
- > 95-99.5% empty space
- Support up to 2000x weight
- Many applications!

APL



A 2.5 kg brick is supported by a piece of aerogel with a mass of only 2 grams.



A flower is on a piece of aerogel which...

Aerogel Payloads

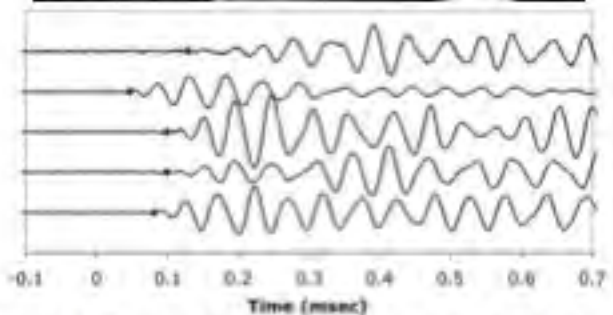


Figure 2. Aerogel filled frame with five PinDrop sensors, and resulting signals.

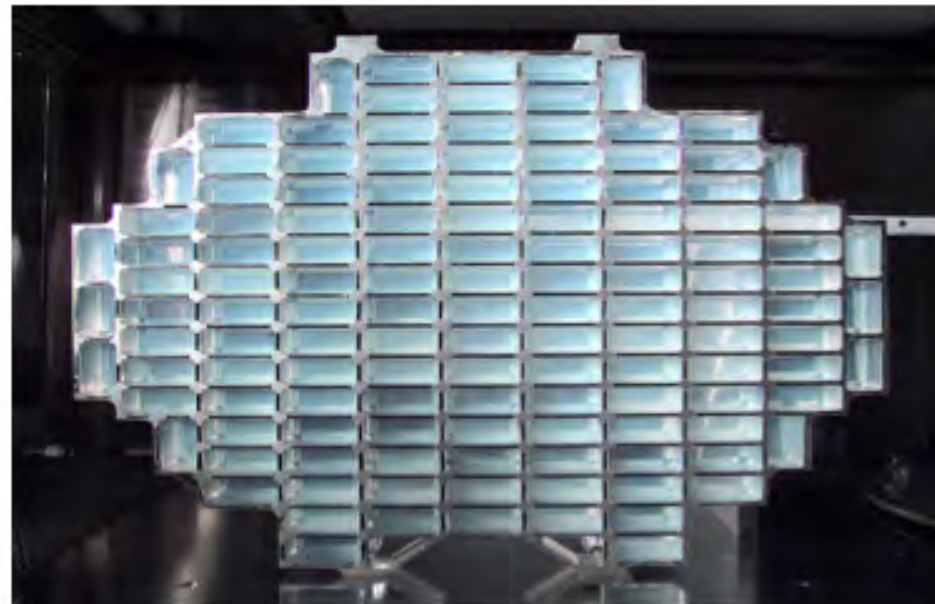
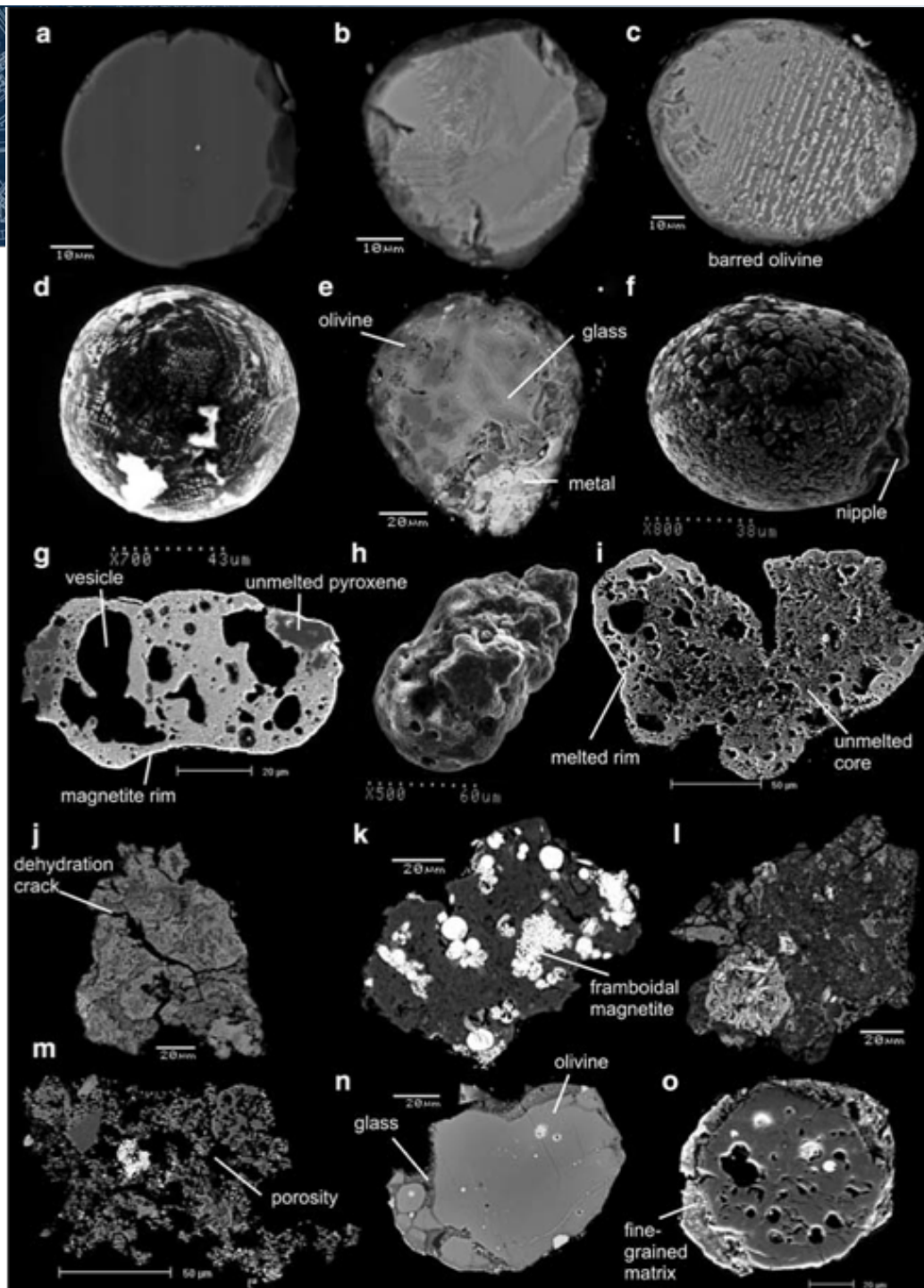


Figure 3. Silica Aerogel particle capture mechanism from the Stardust mission (NASA/JPL).

Dust Collection



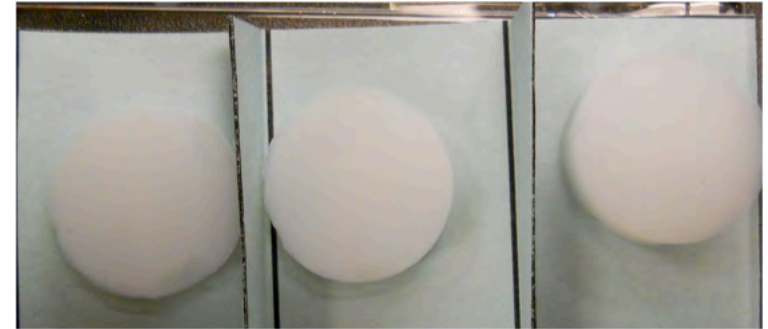
Fig. 2. Example of a Type A impact from Stardust cometary aerogel tray (Level 3 images). Typical track (C038-T7) (Burchell 2008).



Genge, 2009

APL Aerogel Payload Development

Silica aerogel samples synthesized at APL



Critical point dryer; used to convert wet gels to aerogels.



Prototype teflon sensor head.



Capturing the Dust?...

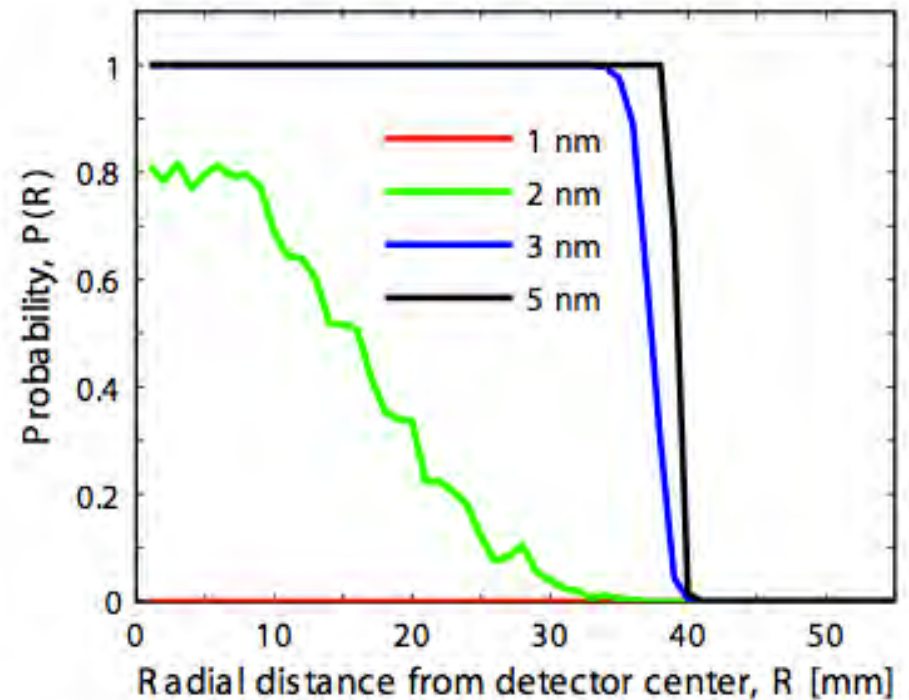
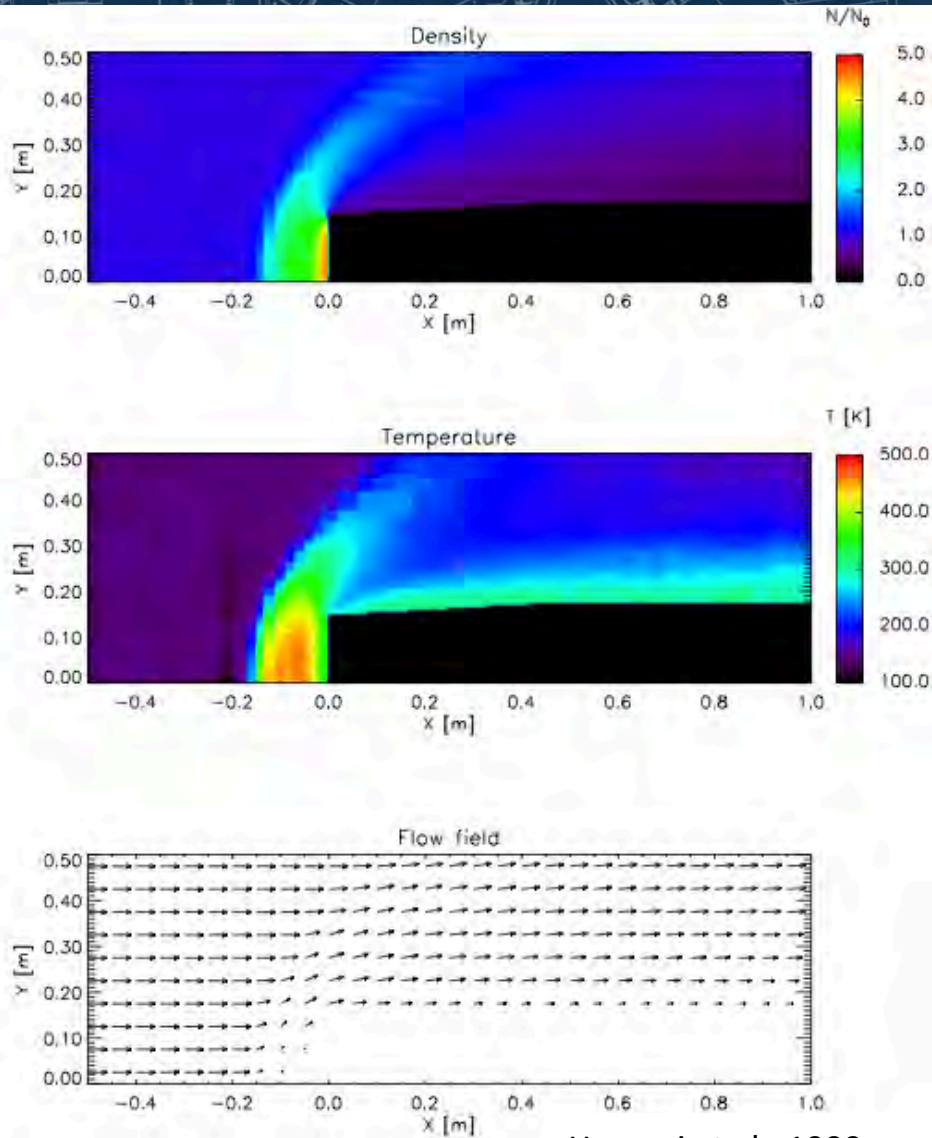


Fig. 4. Detection probability for 1, 2, 3 and 5 nm radius positively charged particles with the Brownian motion model for the unventilated detector at an altitude of 85 km.

Conclusions

- Aerogel based sample return provides an opportunity for novel scientific investigations to support studies of in atmosphere and primitive body research
- Still early TRL development at APL, but proven technology has been demonstrated during previous satellite missions.
- sRLV provide an excellent platform for D-region studies and increasing TRL/Heritage of instrumentation in a cost effective manner.