

2016 NTNU ESSSP PART A To Measure Earth's Upper Atmosphere

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ESRL Global Monitoring Division

- To measure the atmospheric distribution and trends of the three main long-term drivers of climate change, CO₂, CH₄, N₂O, CO.....
- Taiwan: Lu-lin Observatory only.
→ Need to create more database for Taiwan.
- Can be used for model data assimilation, parameterization of vertical transportation flux of carbon (Karion et al., 2010).

AirCore & Micro-AirCore

AirCore (Karion et al., 2010)

Micro-AirCore (Favela et al., 2012)

Length

152 m

30 m

Internal
Diameter

0.615 cm

0.53 mm

Weight

6.75 kg

< 28 g

Material

304-grade stainless tube

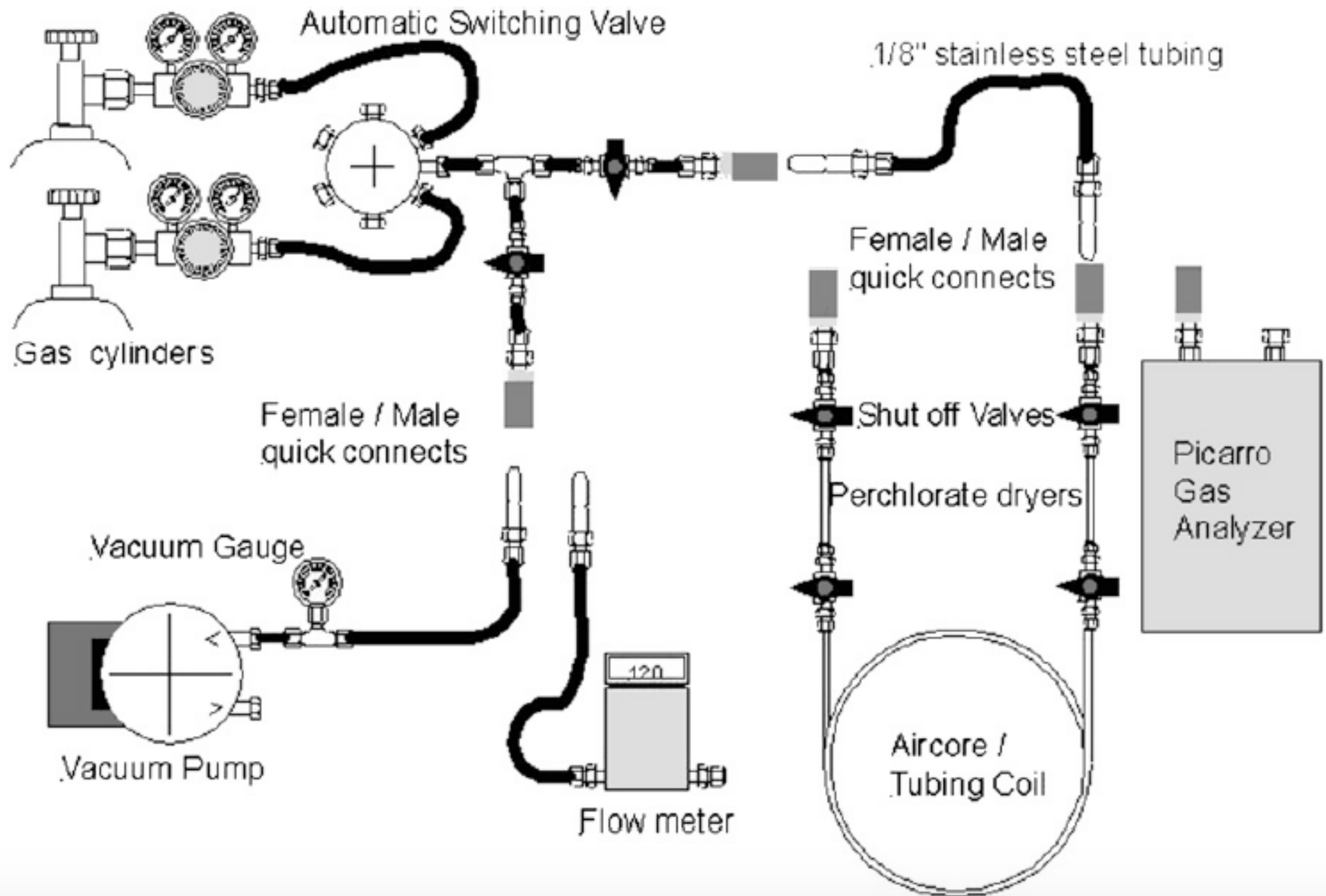
Restek hydroguard fused silica.

Photo



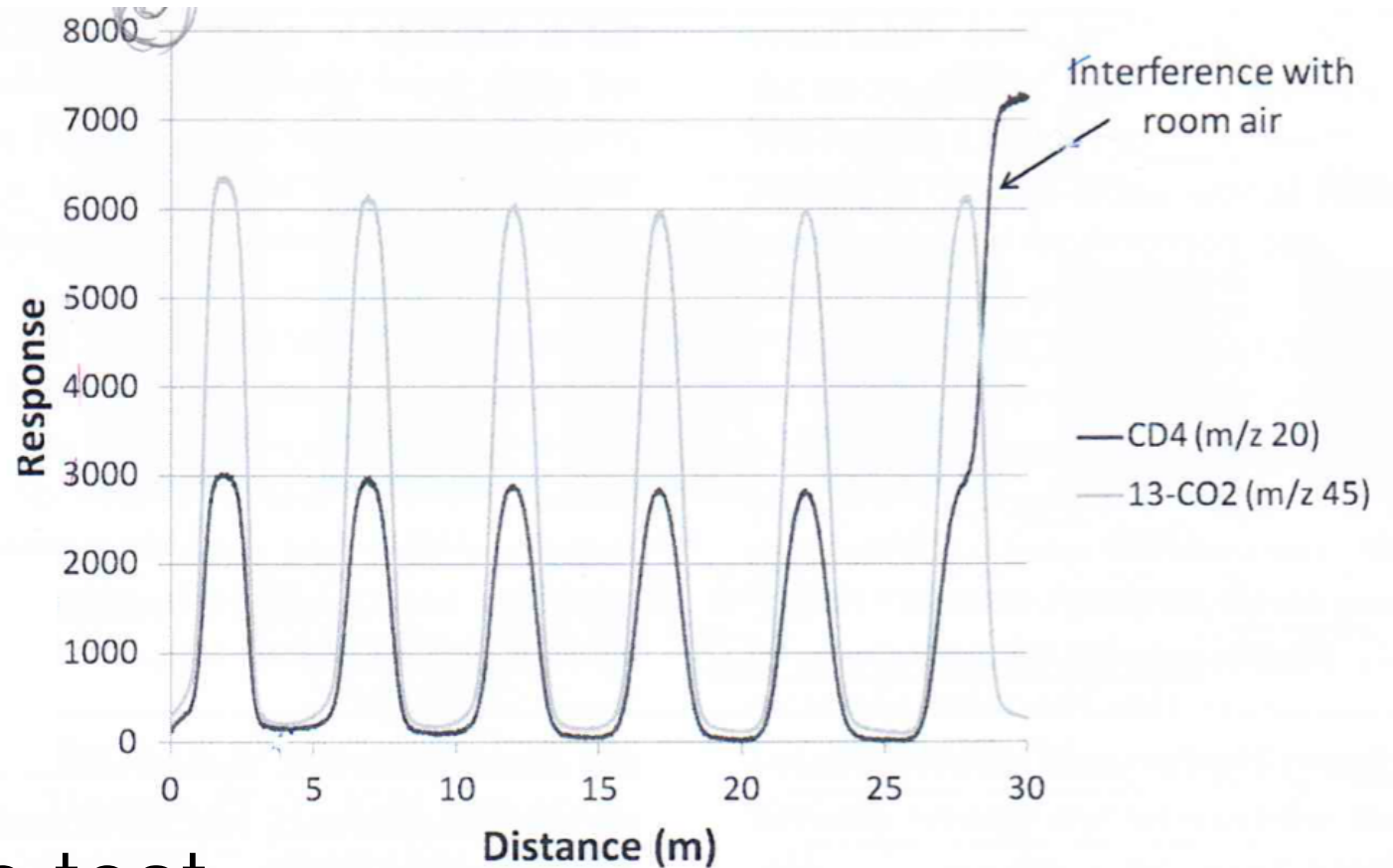
Lab Set Up

(Karion et al.,
2010)

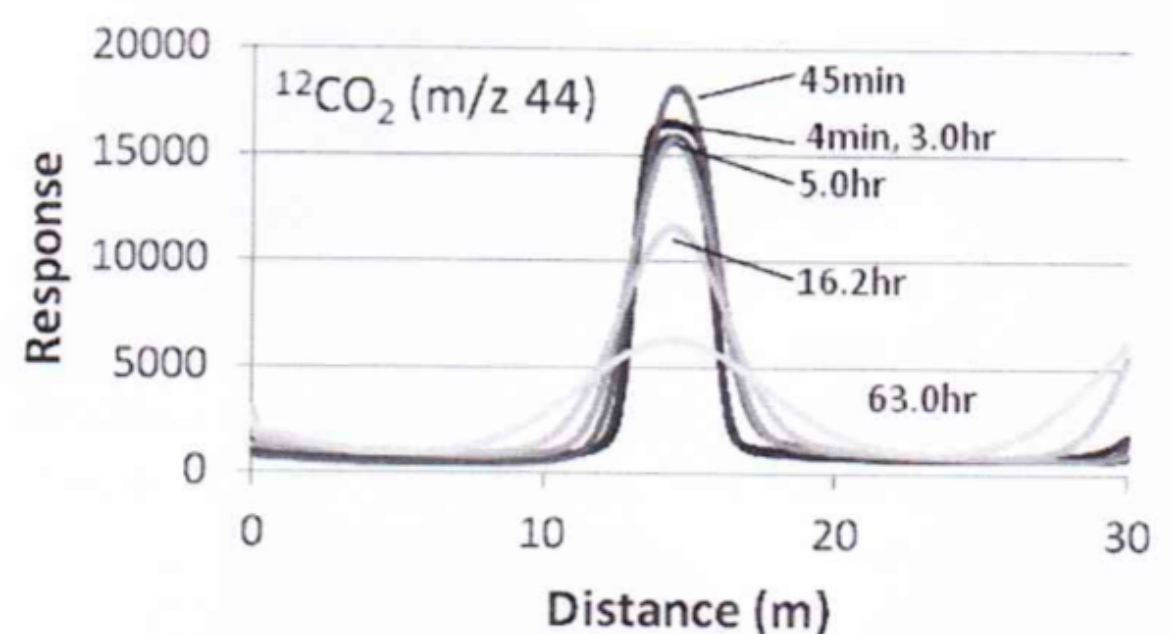
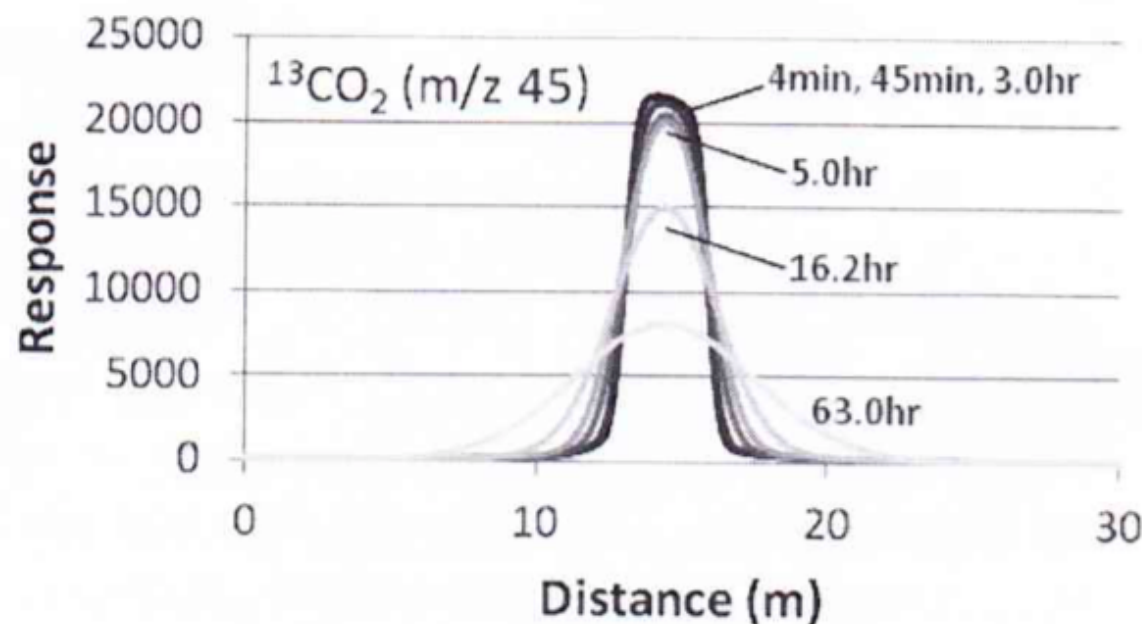


Lab Works to do (Favela et al., 2012)

(a) Memory Retainment of Gas Samples Varied with Distance.



(b) Hold time and Diffusion test.



PART B

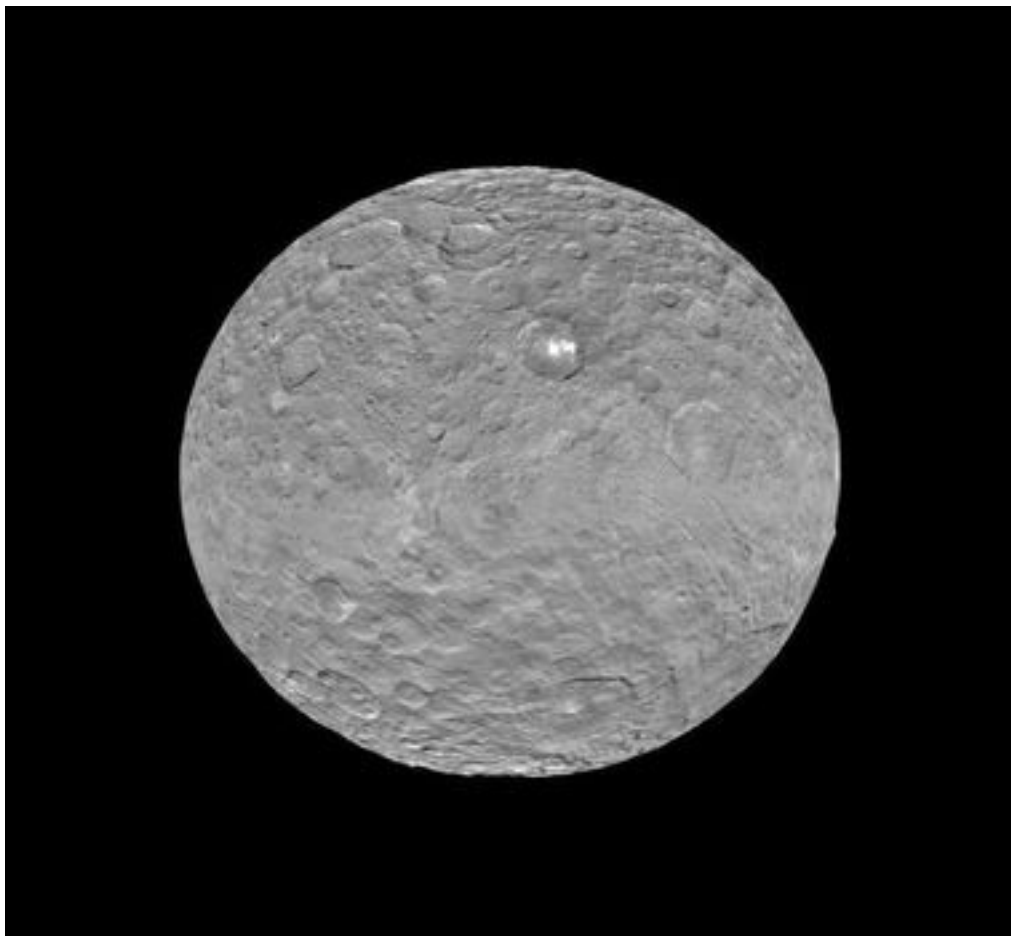
An Exospheric Model of Ceres

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Introduction to Ceres

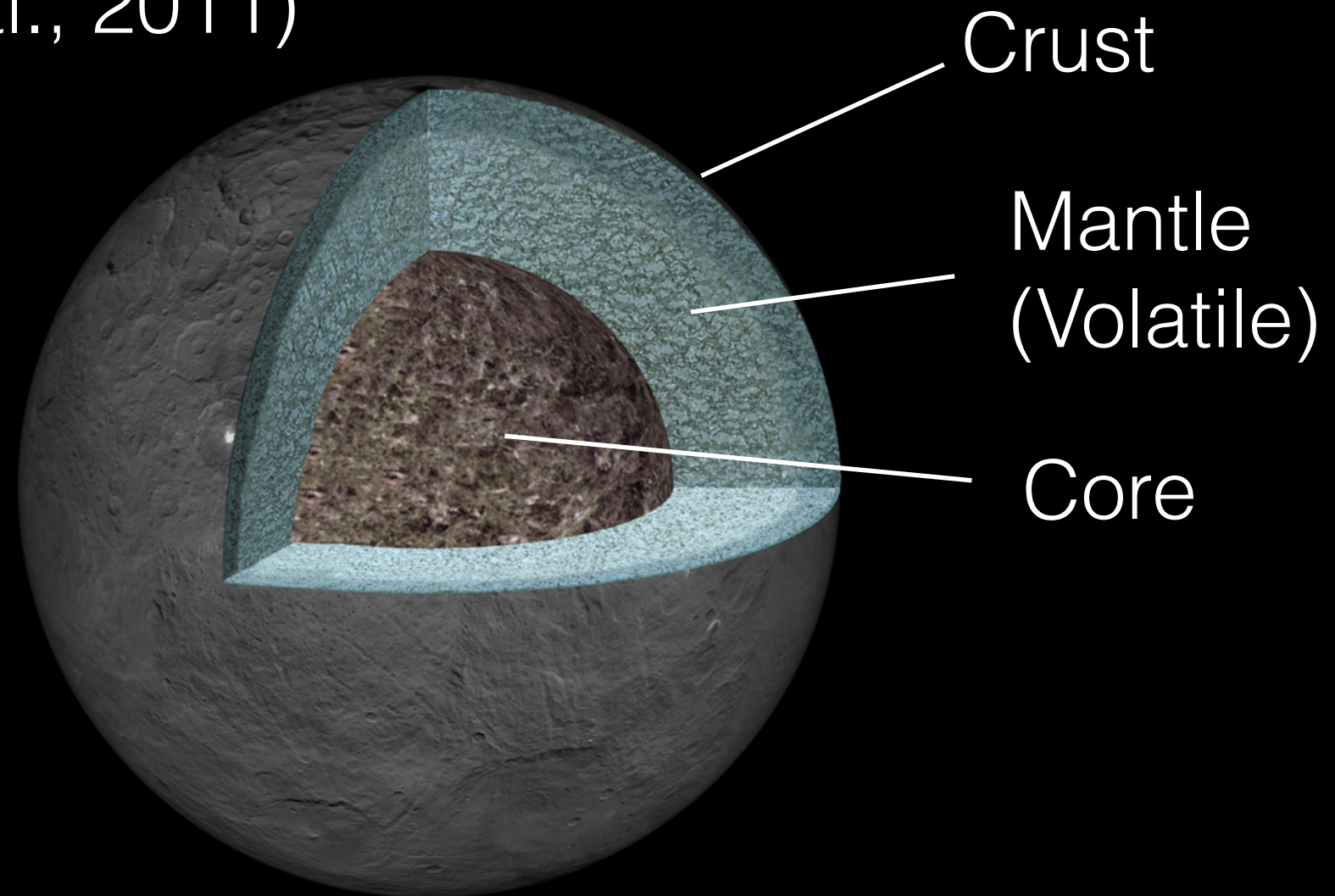
- An dwarf planet at astroid belt.
- Near spherical object.



Diameter	~ 939 km
Mass	9.39×10^{20} kg
Rotational Period	9.074 hrs
Escape Velocity	~ 0.515 km/s
Distance to Sun	~2.77 AU
Max. Surface Temperature	235 K

Internal Structure

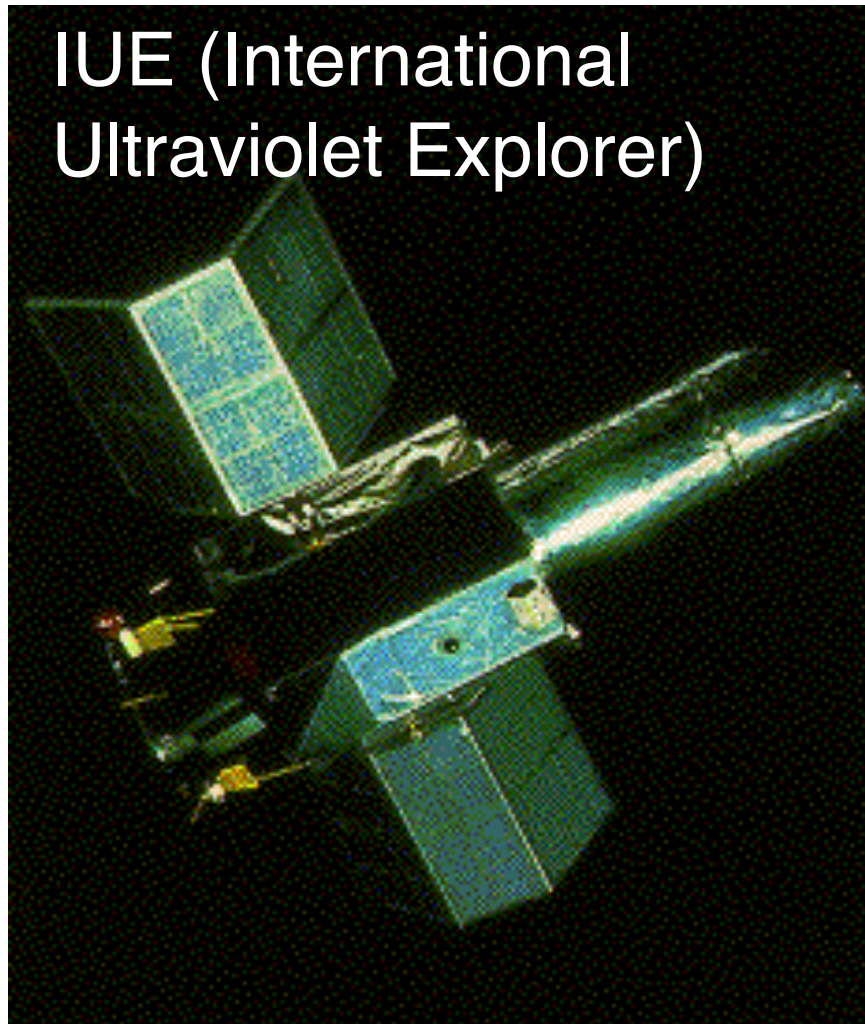
Contain at least 25% of water! (Rivkin et al., 2011)



(from DAWN mission website)

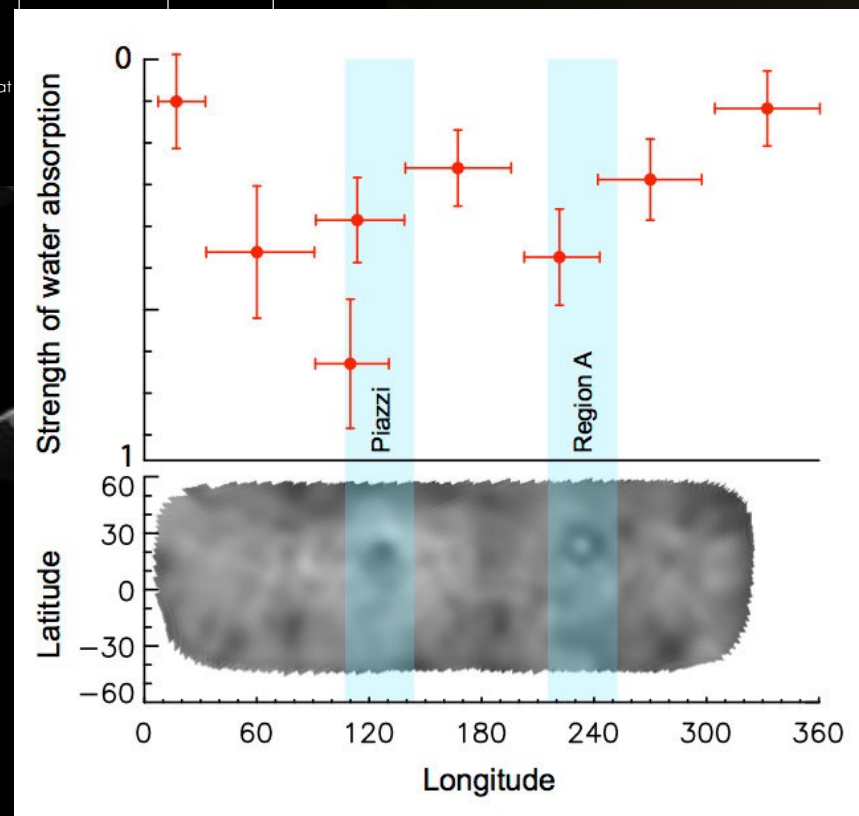
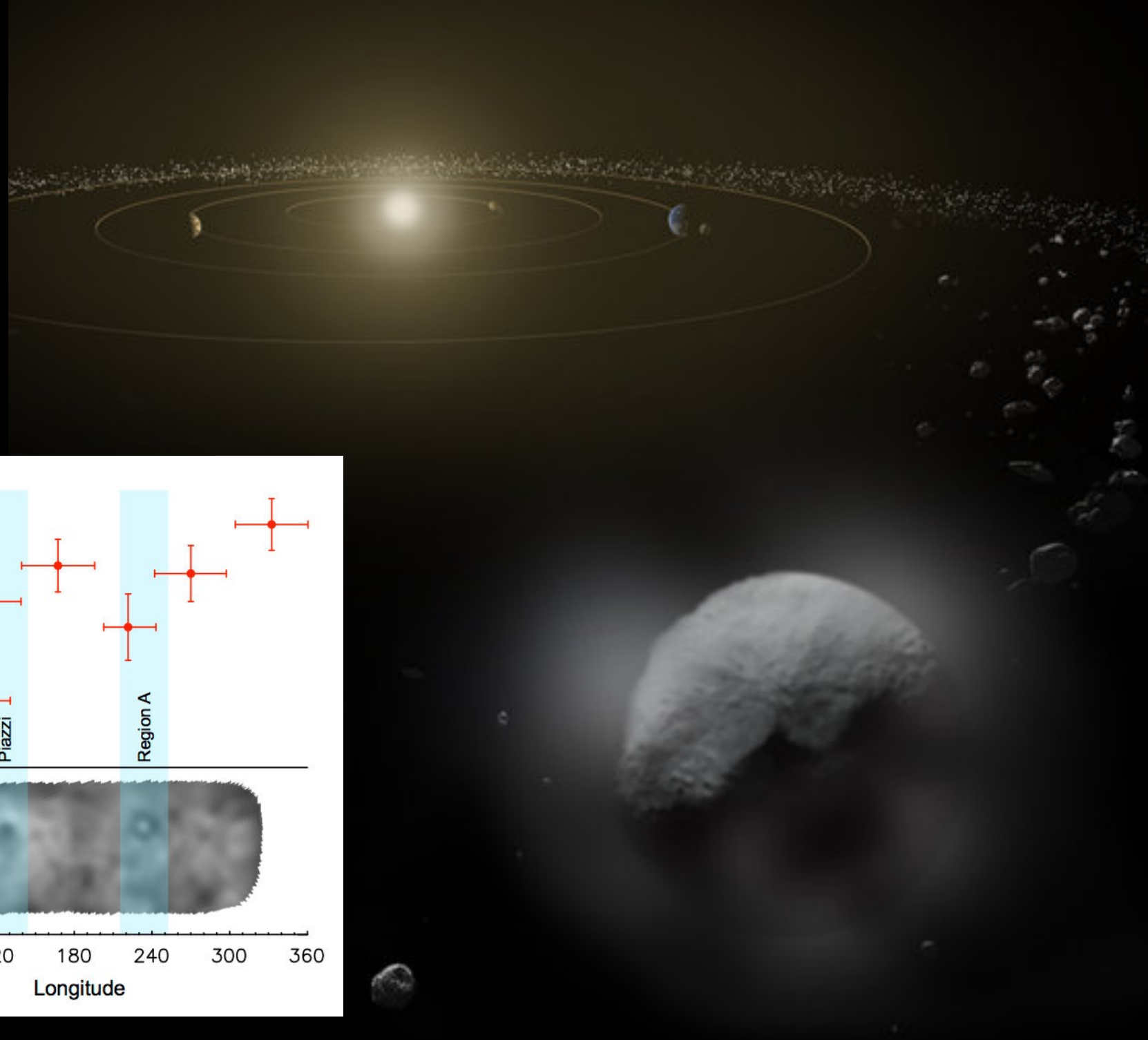
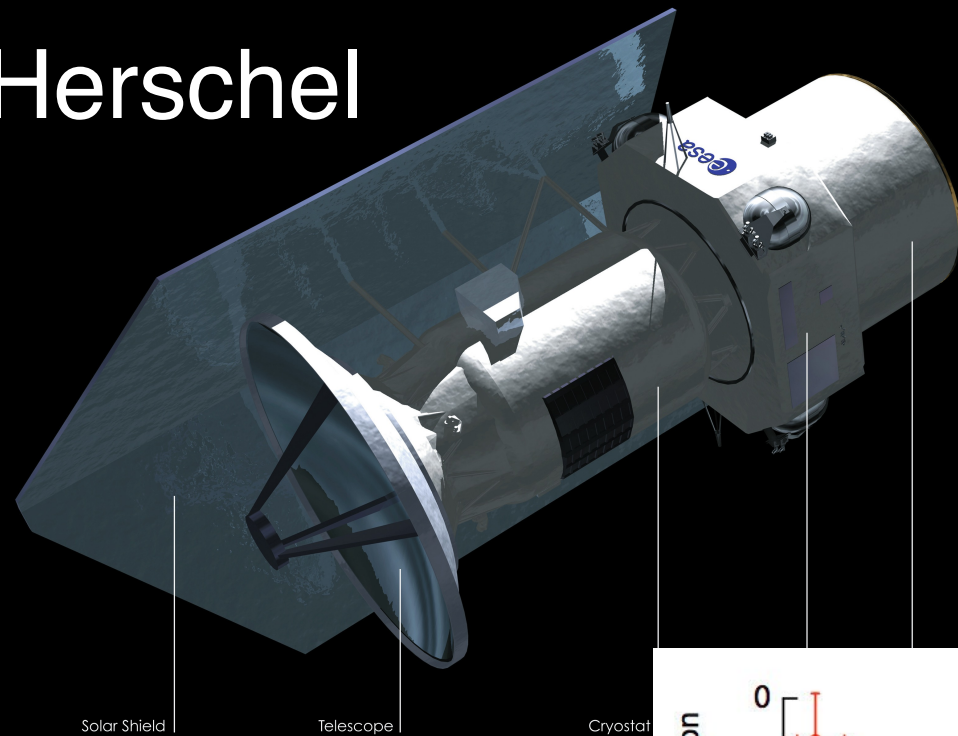
Exosphere Discovered

- IUE observatory detected **OH**⁺ emission near the north pole. (A'Hern & Feldman, 1992)
- Using UVES to estimate the limit of sublimation rate of $7 \times 10^{25} \text{ s}^{-1}$ (Rousselot et al., 2011)

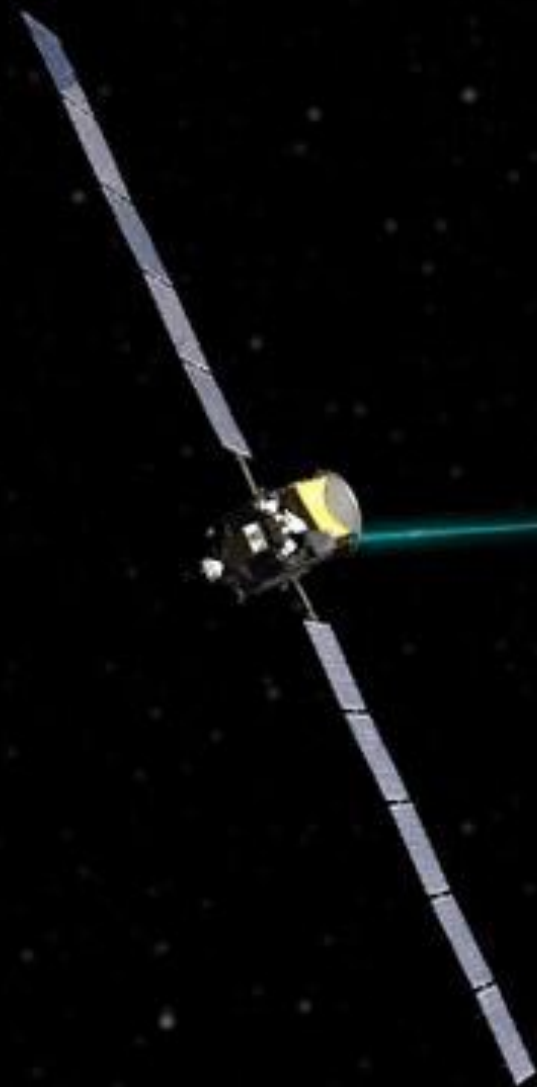


- Herschel Space Observatory using Far Infrared:
water vapor forms a tenuous exosphere on Ceres.
(Küppers et al., 2014)

Herschel

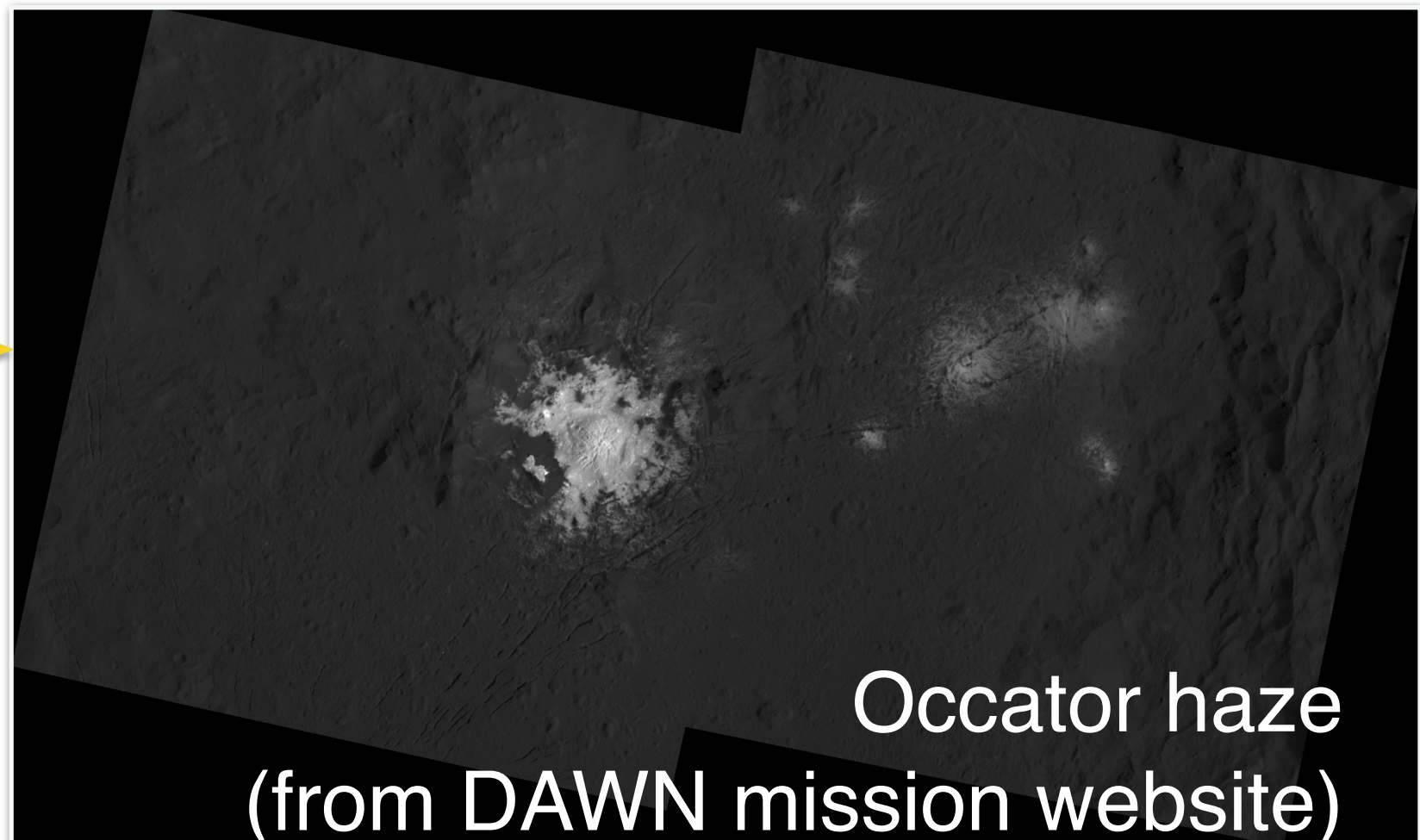
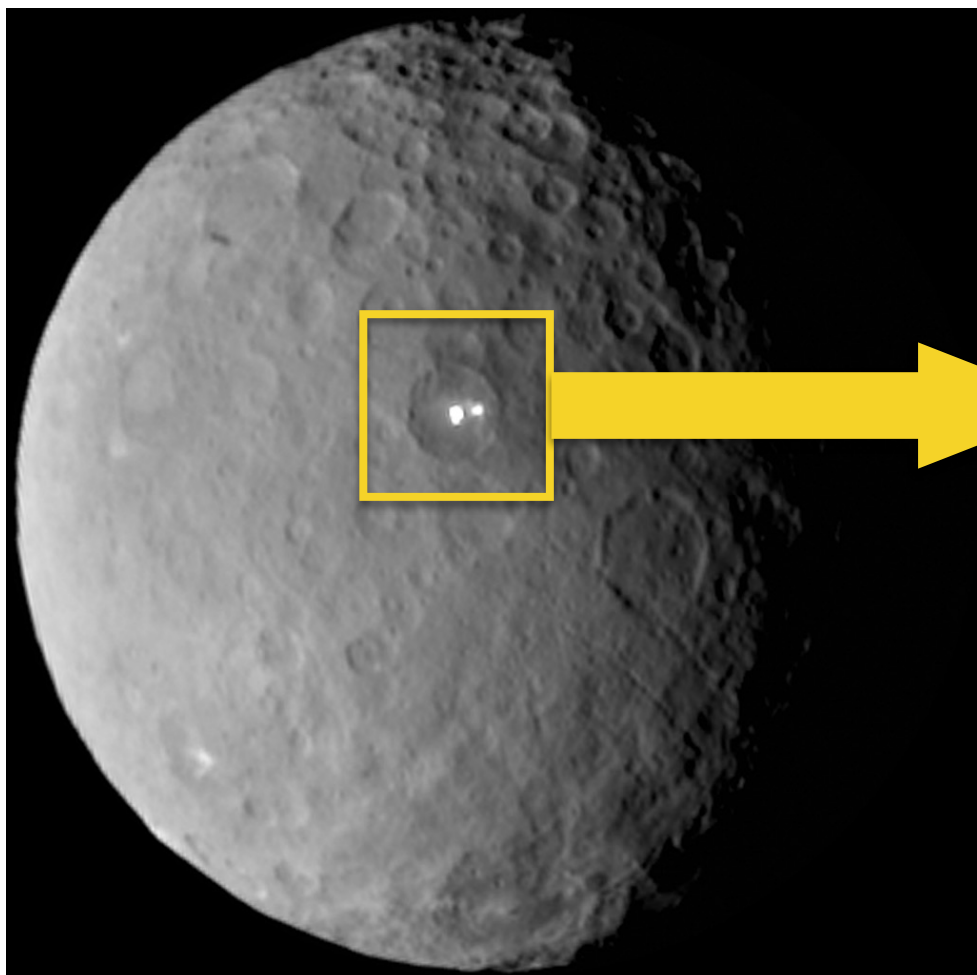


DAWN Mission



- 2007~Now.
- Goal: to explore Ceres and Vesta in order to characterize the conditions and processes of its earliest history.
- Mainly geology use.

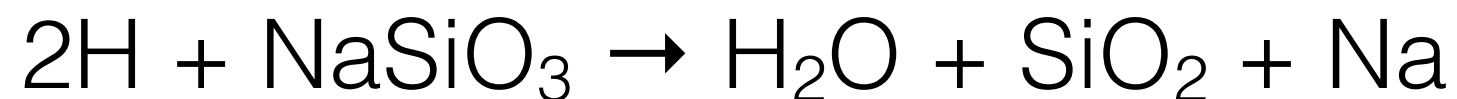
- DAWN spacecraft discovered some bright area over the surface → Volatile materials!
- We would like to realize the distribution of the gases and the results can be proved by advance observations in the future.



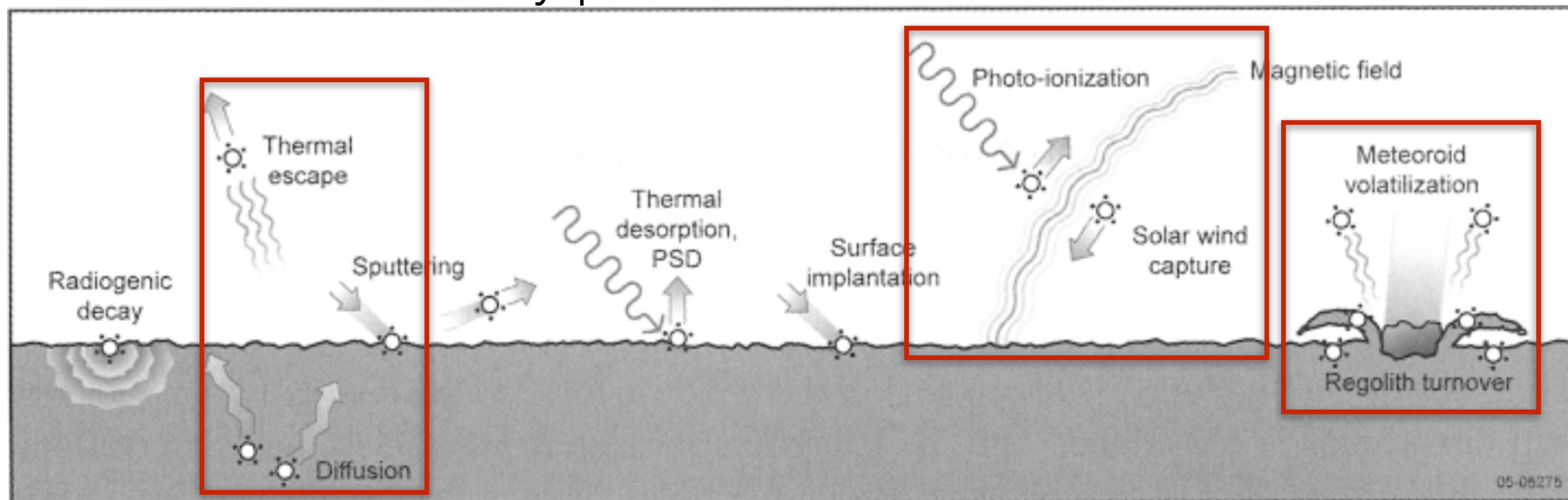
Source Mechanisms

(Domingue et al.,
2007)

1. **Thermal sublimation process.**
2. **Micrometeoroid bombardment.**
3. **Solar wind interaction:** (Potter, 1995)



⇒ O atom may produce!!!

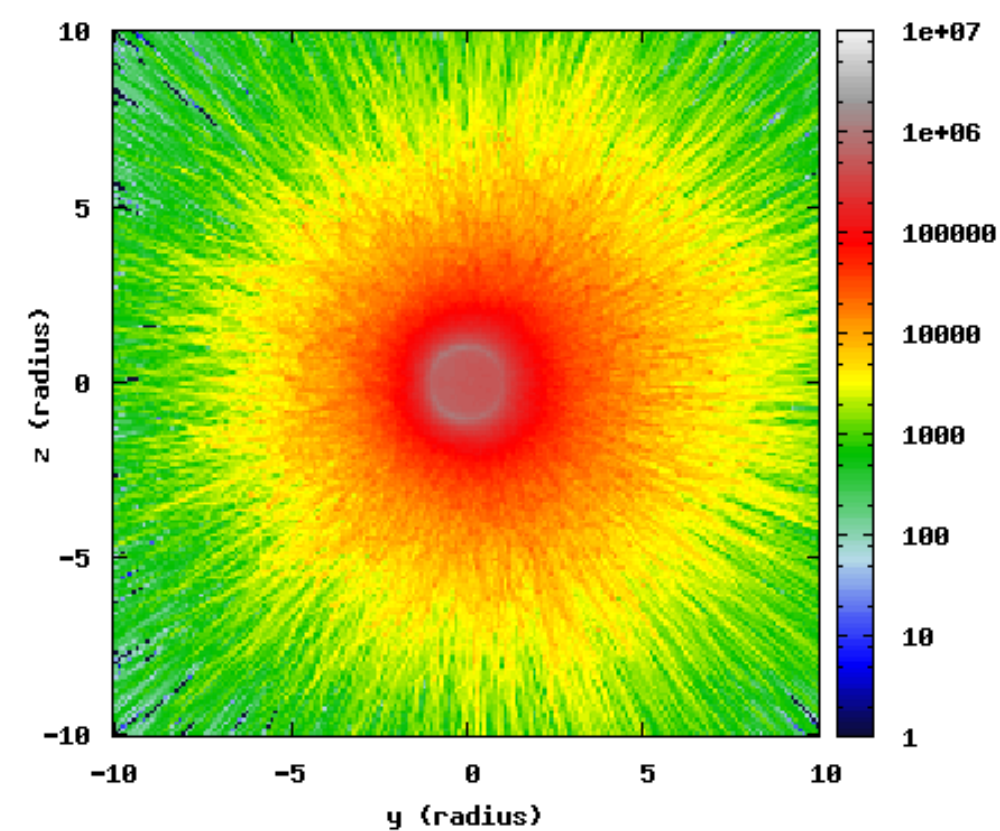
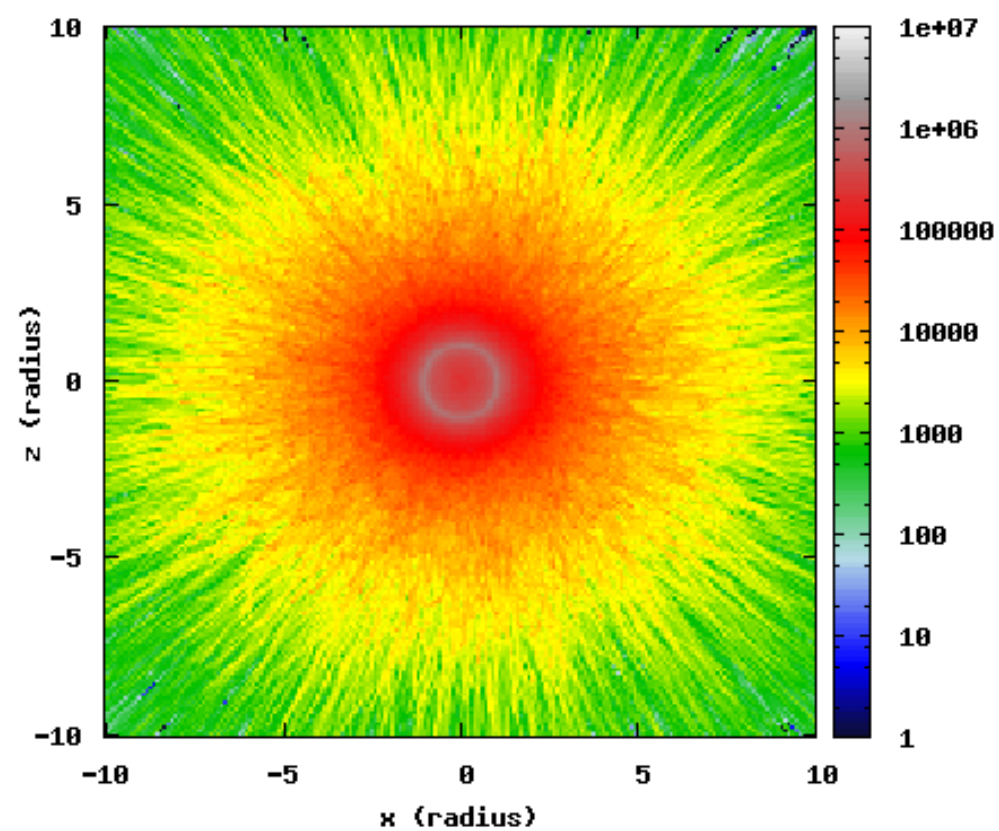


Global

x - z plot

y - z plot

O_2



O_3

