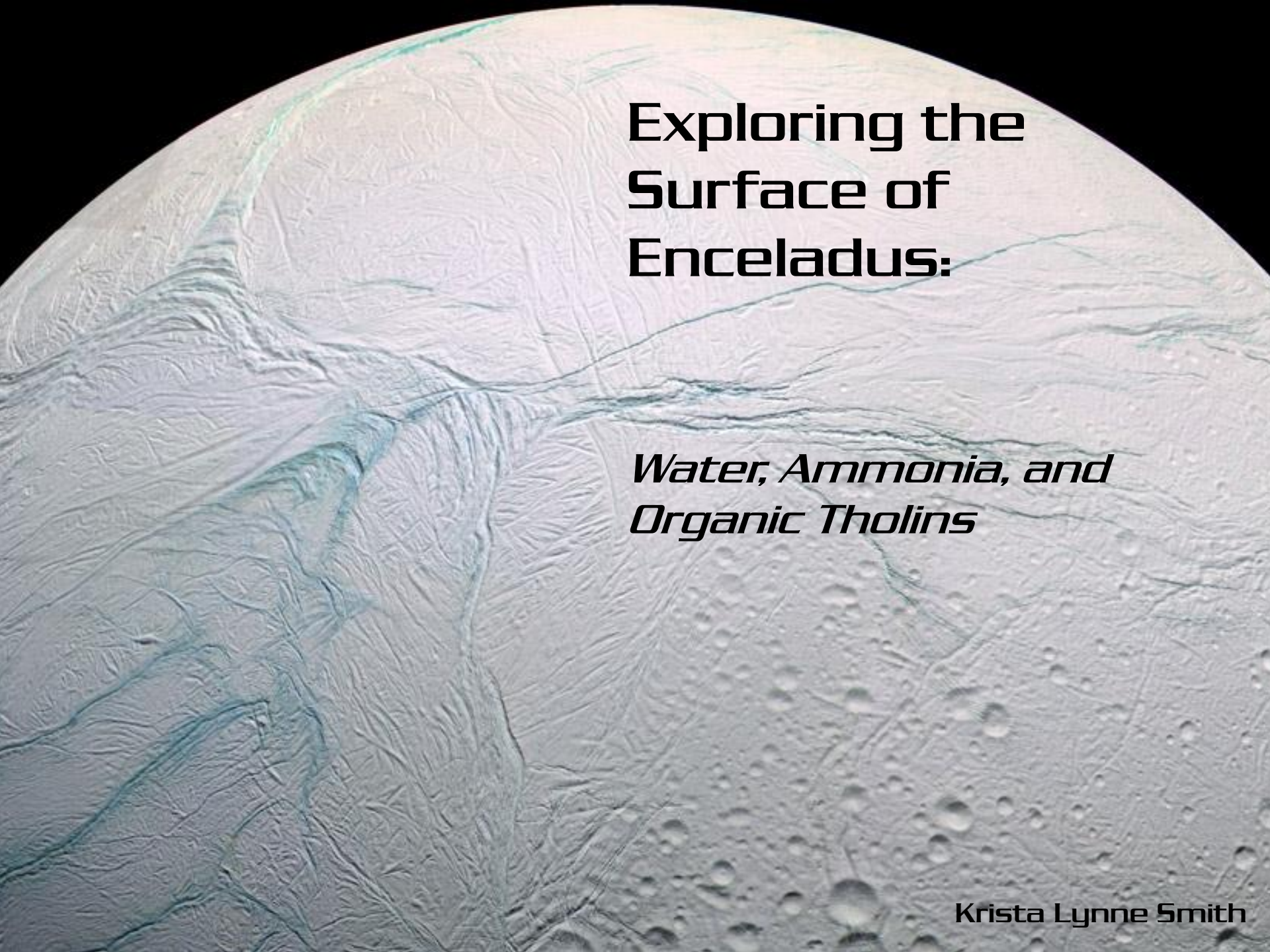
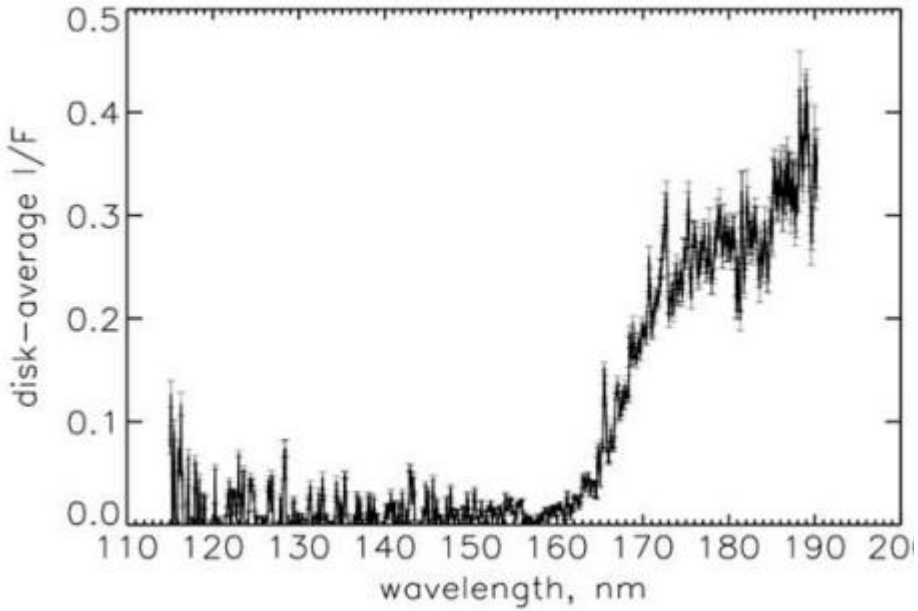


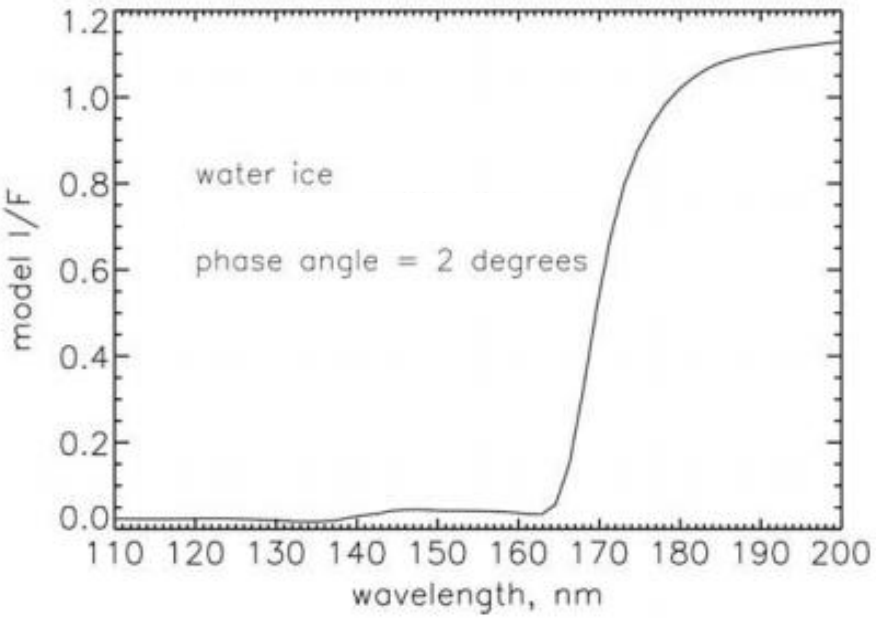
Exploring the Surface of Enceladus:

Water, Ammonia, and Organic Tholins

Krista Lynne Smith

Hendrix et al. 2010: UVIS Spectra of Enceladus



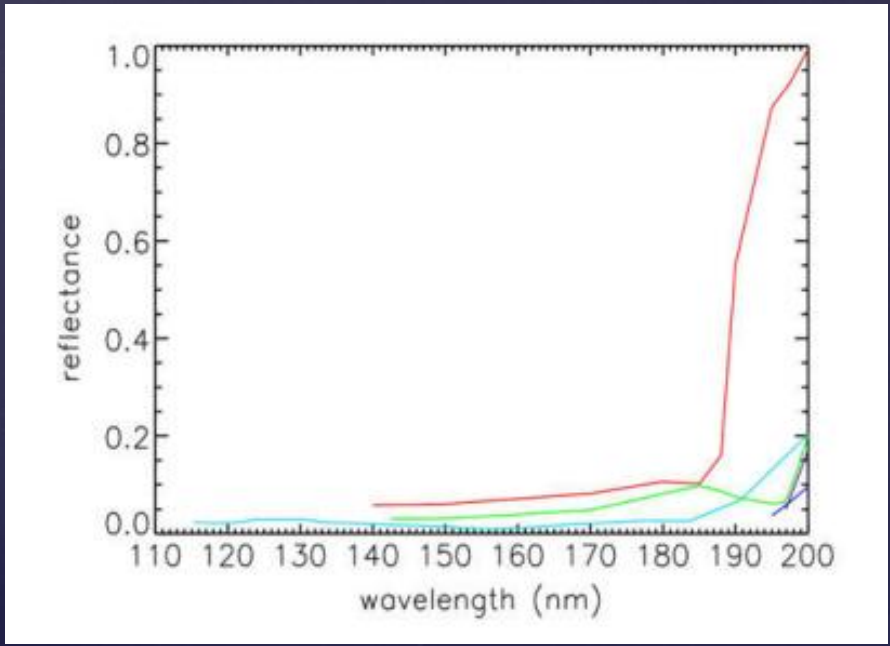


- Far-UV reflectance spectrum
- Too dark between 170 – 190 nm for pure water ice
- Candidate contaminants must differ from water substantially between 160 and 200 nm:
  - Ammonia Ice
  - Carbon Dioxide
  - Tholins

Hapke [2002]: Detailed Surface Modeling

- Models the reflectance of a surface: the albedo times a correction factor.
- Incorporates mixtures of different materials.

Ammonia Ice:



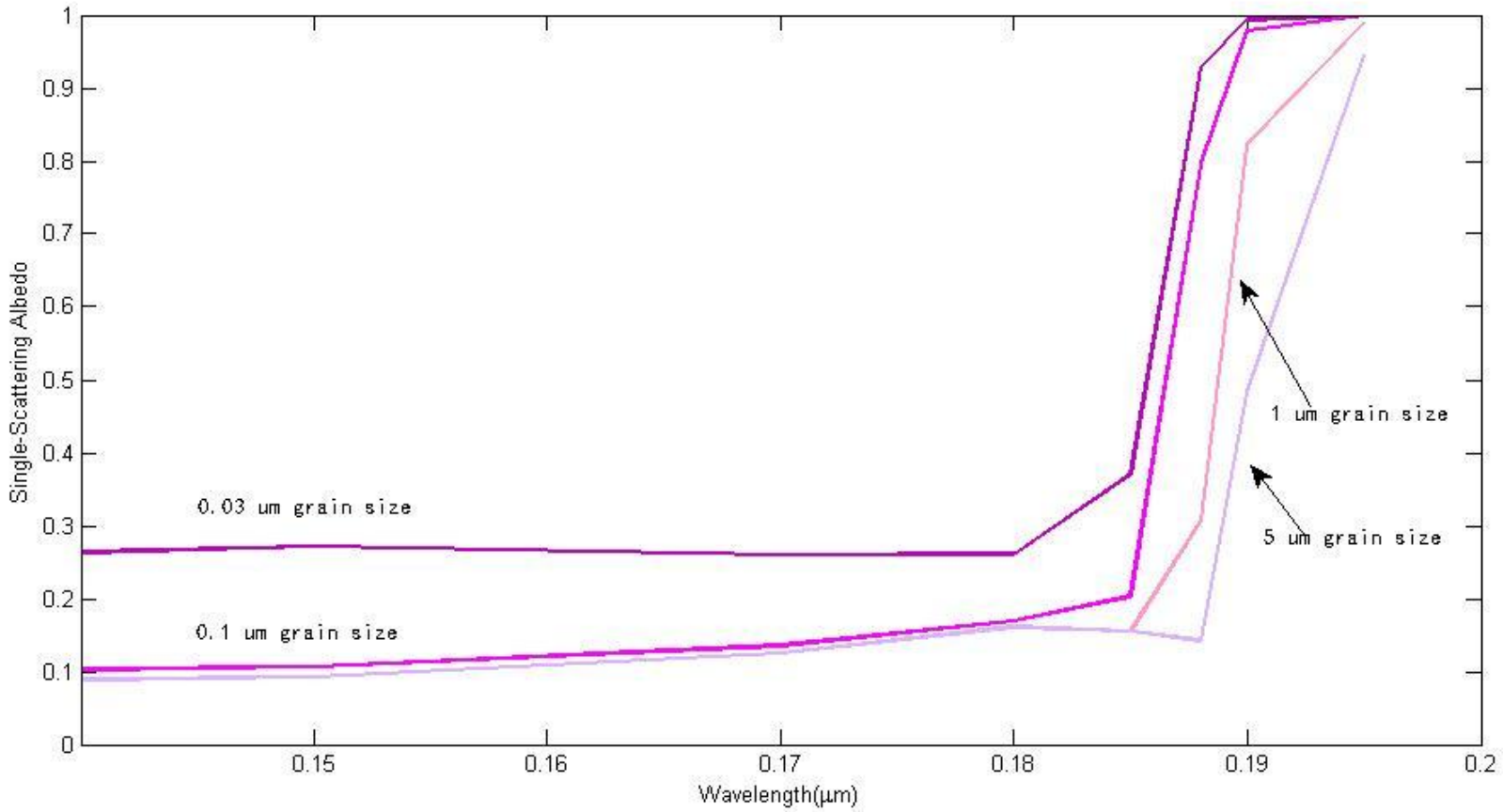
$$r = \frac{w}{4}\frac{\mu_0}{\mu+\mu_0}\left[\left(1+B(\alpha,h)\right)P(\alpha,g) + H(\mu)H(\mu_0)-1\right]R(\overline{\Theta}).$$

Single-Scattering Albedo

Correction factor:
- Coherent Backscatter
- Shadow Hiding
- Large Scale Roughness

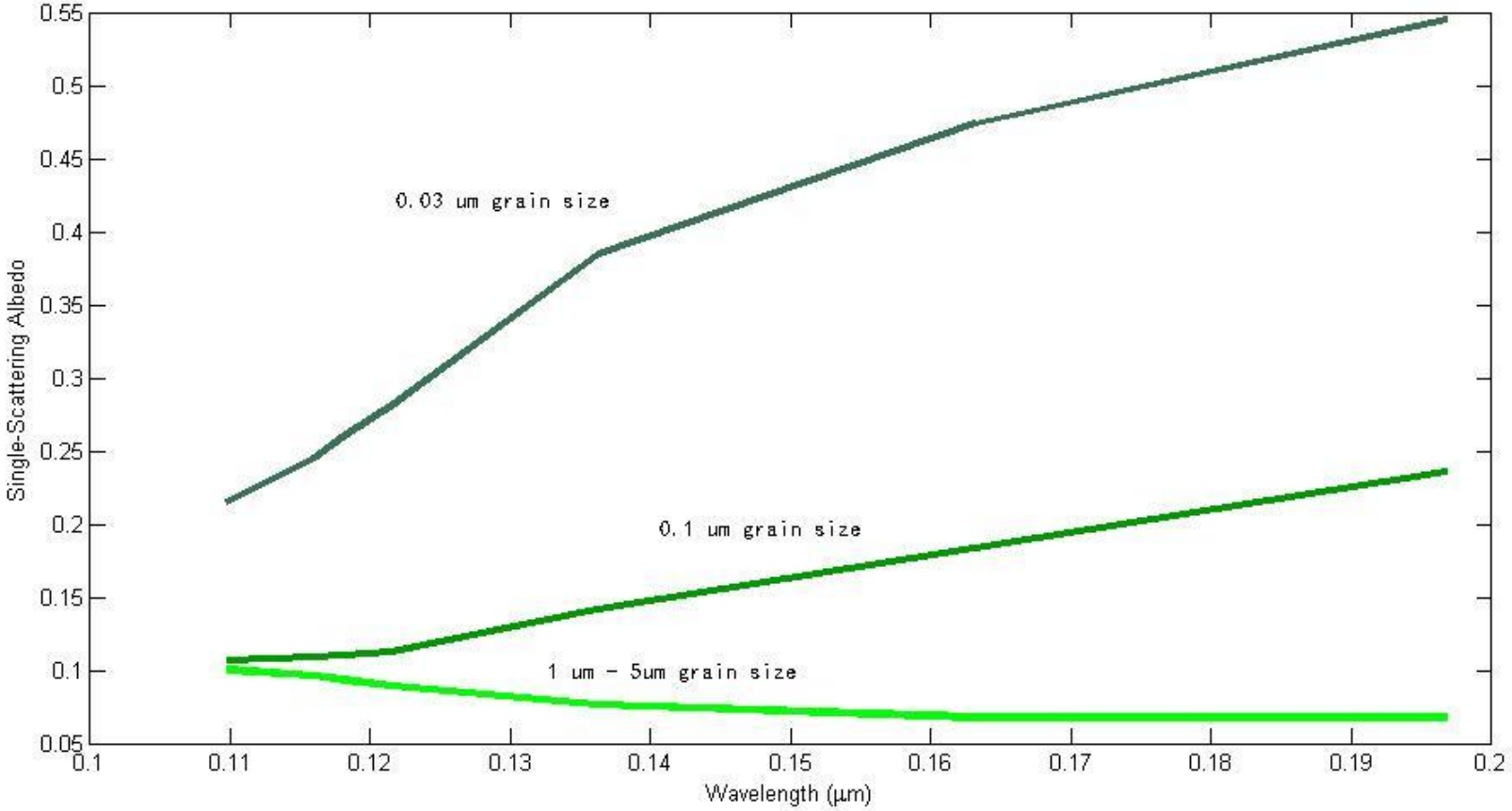
New Models: Various Grain Sizes

Ammonia Ice:



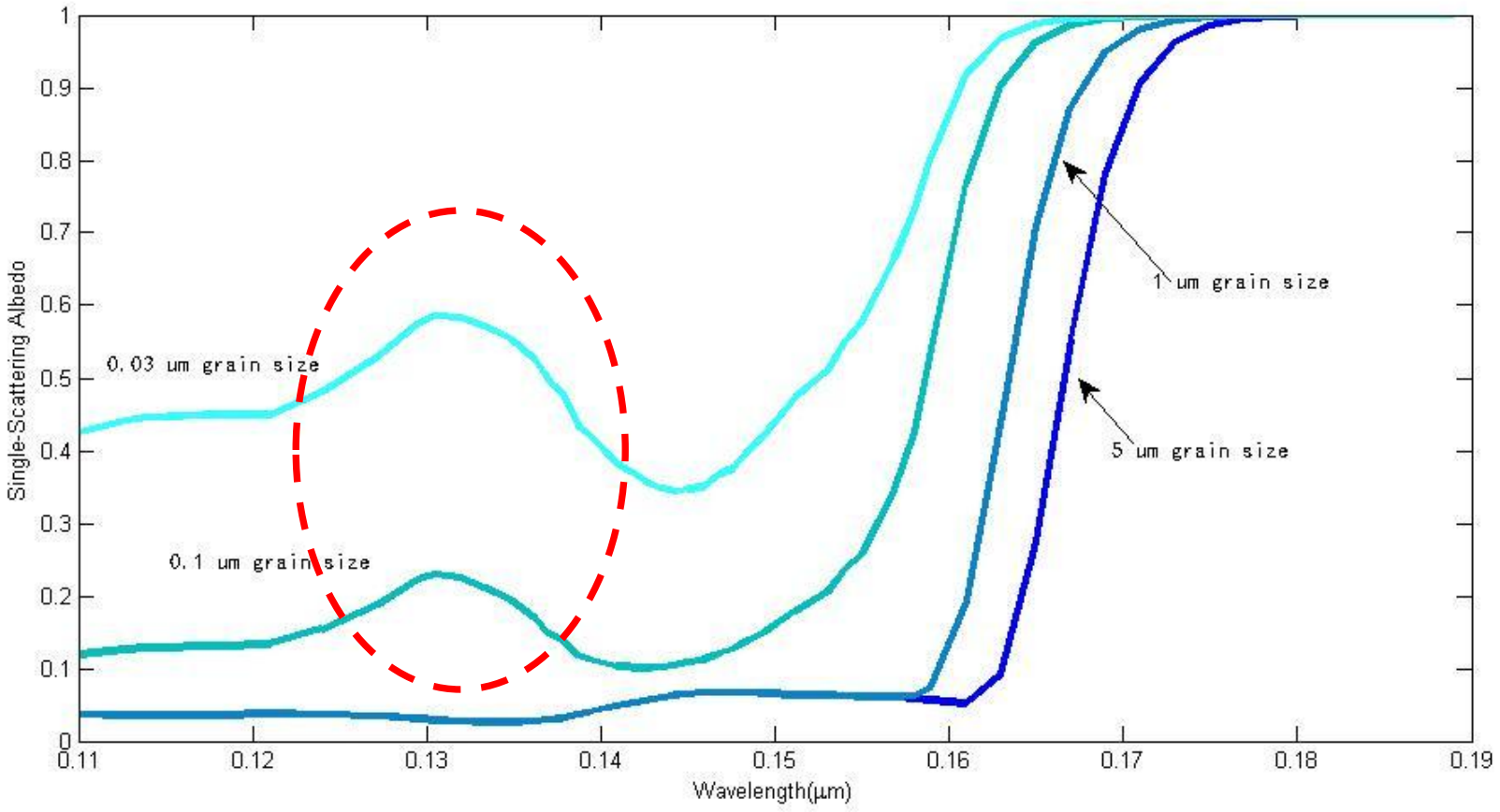
New Models: Various Grain Sizes

Tholins:



New Models: Various Grain Sizes

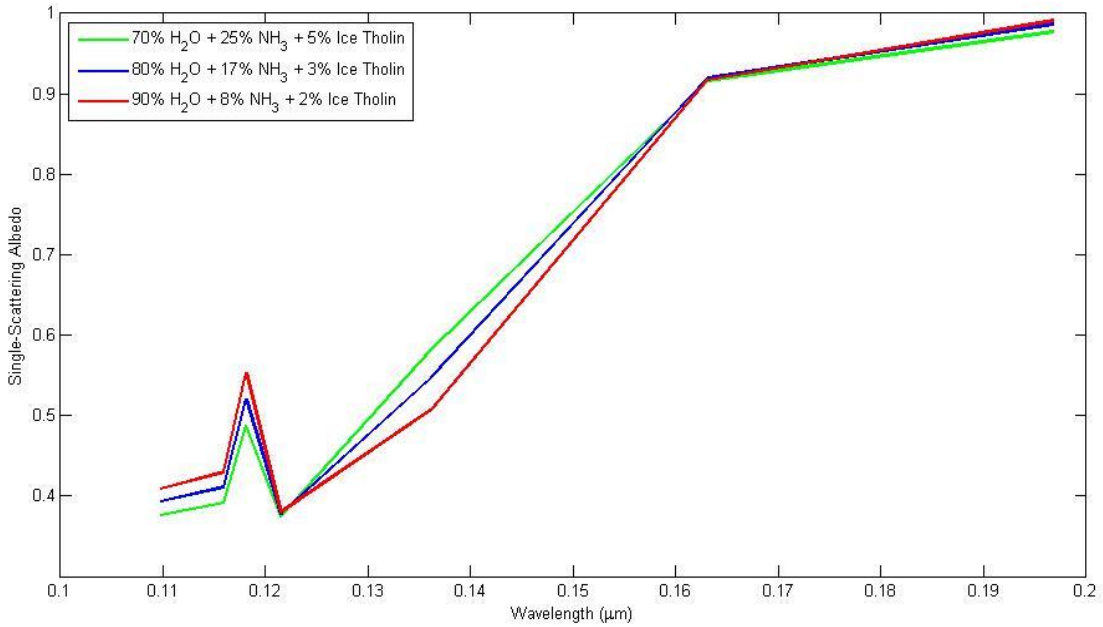
Water Ice:



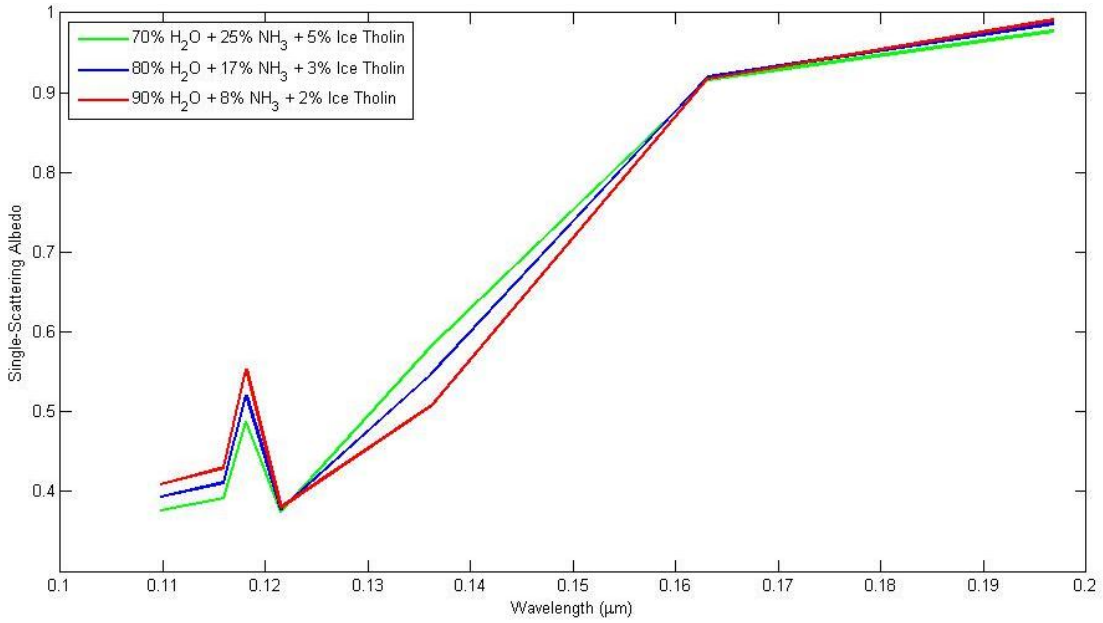
Prominent reflectance feature inconsistent with observations.

New Models: Areal Compositional Mixtures

0.03 μm

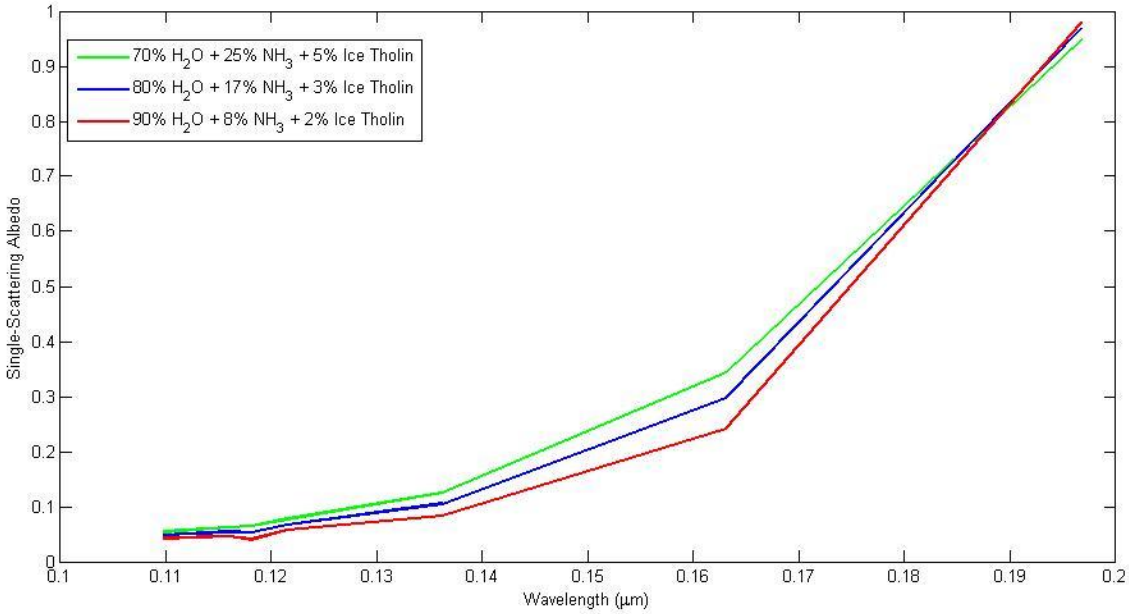


0.1 μm

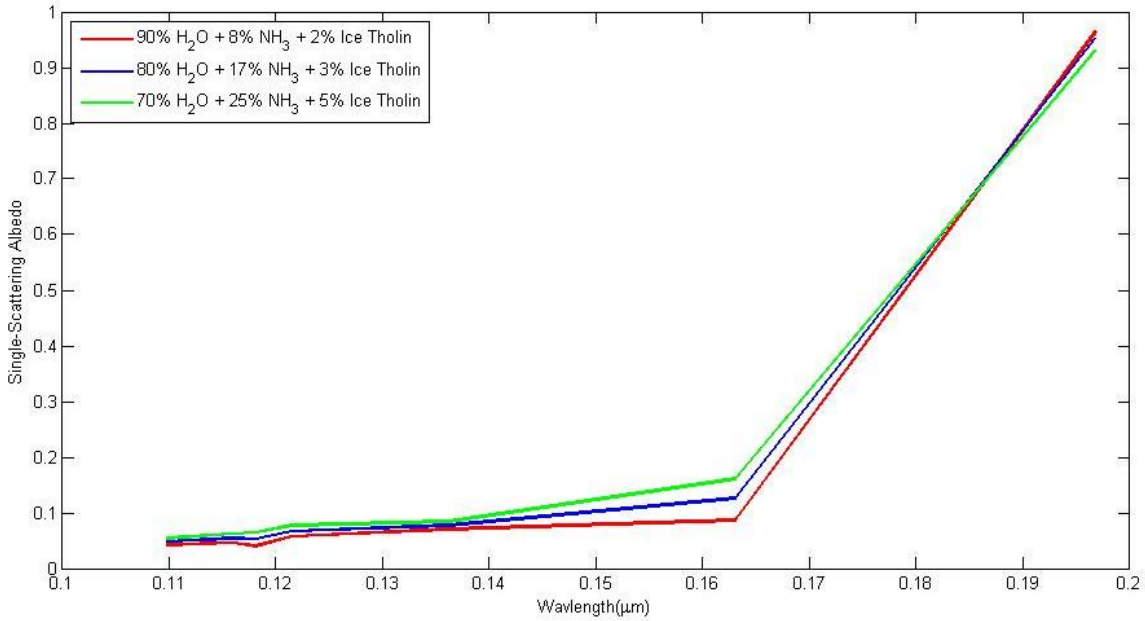


New Models: Areal Compositional Mixtures

1 μm



5 μm



Summary

- Surface of Enceladus inconsistent with water-ice alone.
- Contaminant most likely ammonia and tholin mixture.
- Grain sizes of water-ice must be >0.1 um.
- Mixtures alter models noticeably, but comparison with observations is not possible.