

Impact cratering and disruption on icy bodies and landscapes

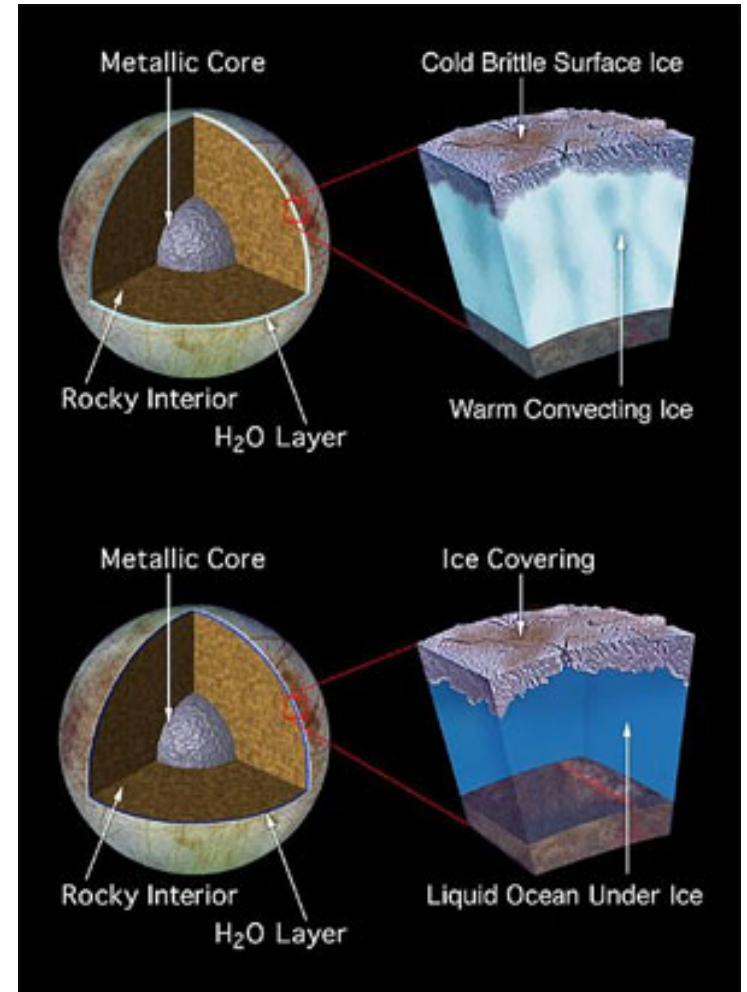
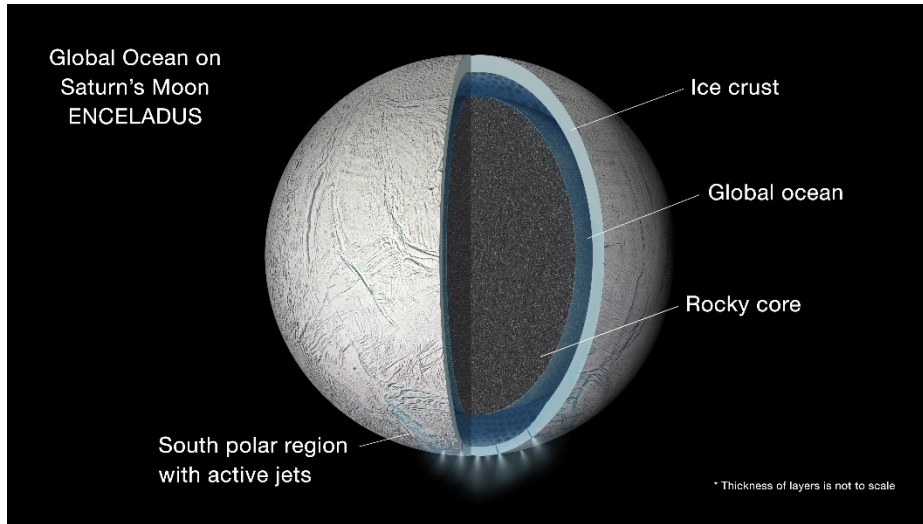
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51st ESLAB Symposium 2017

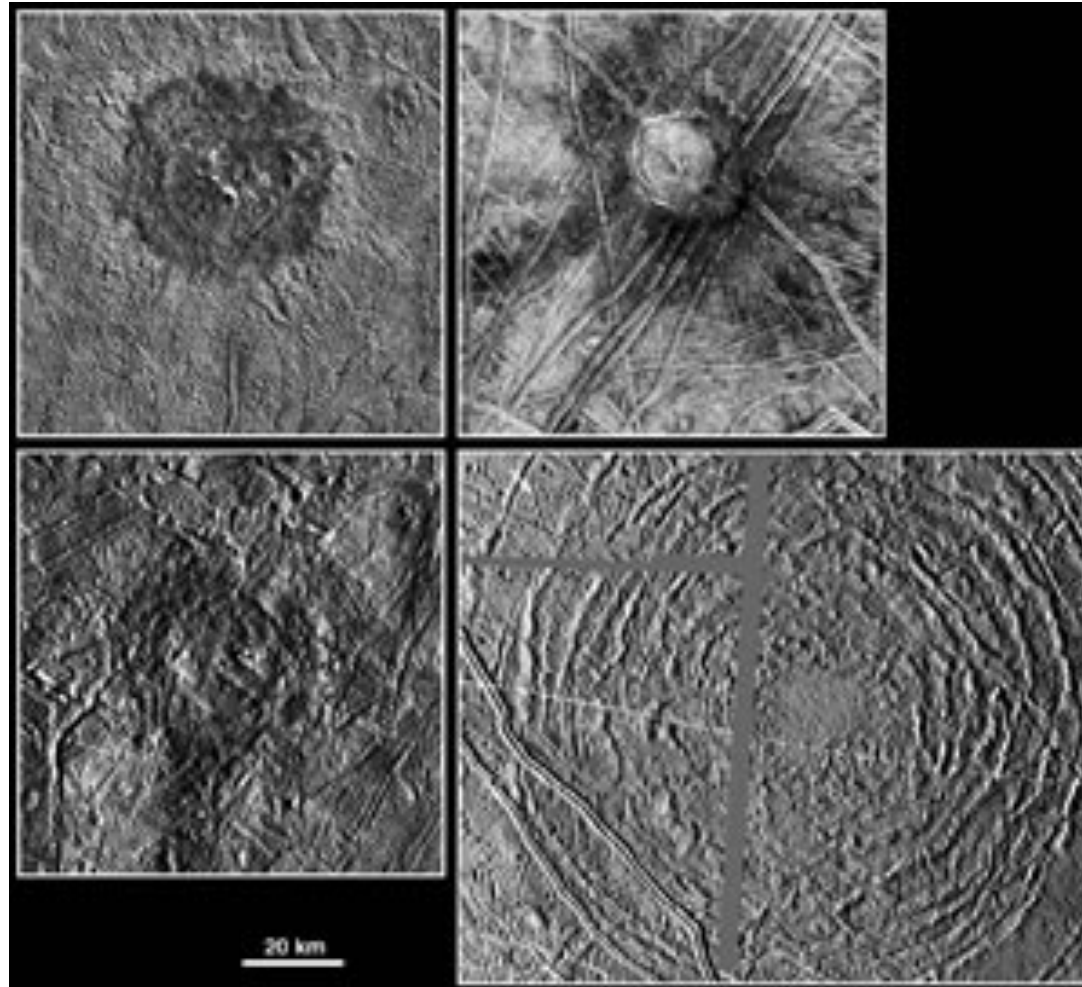
Icy moons with subsurface oceans



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Impact craters on Icy Moons



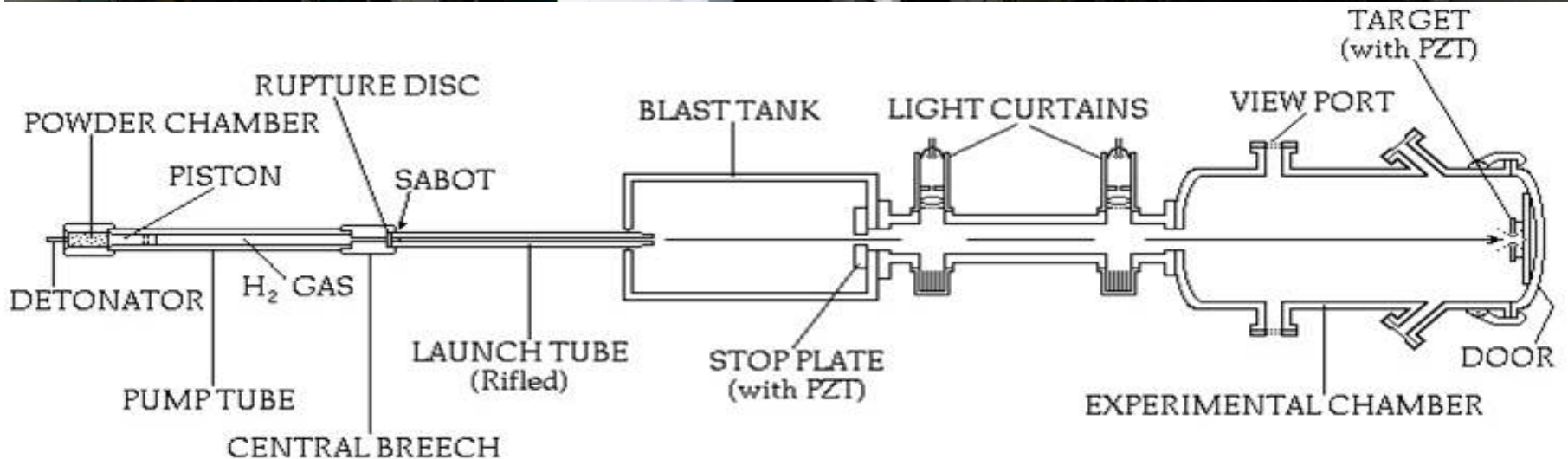
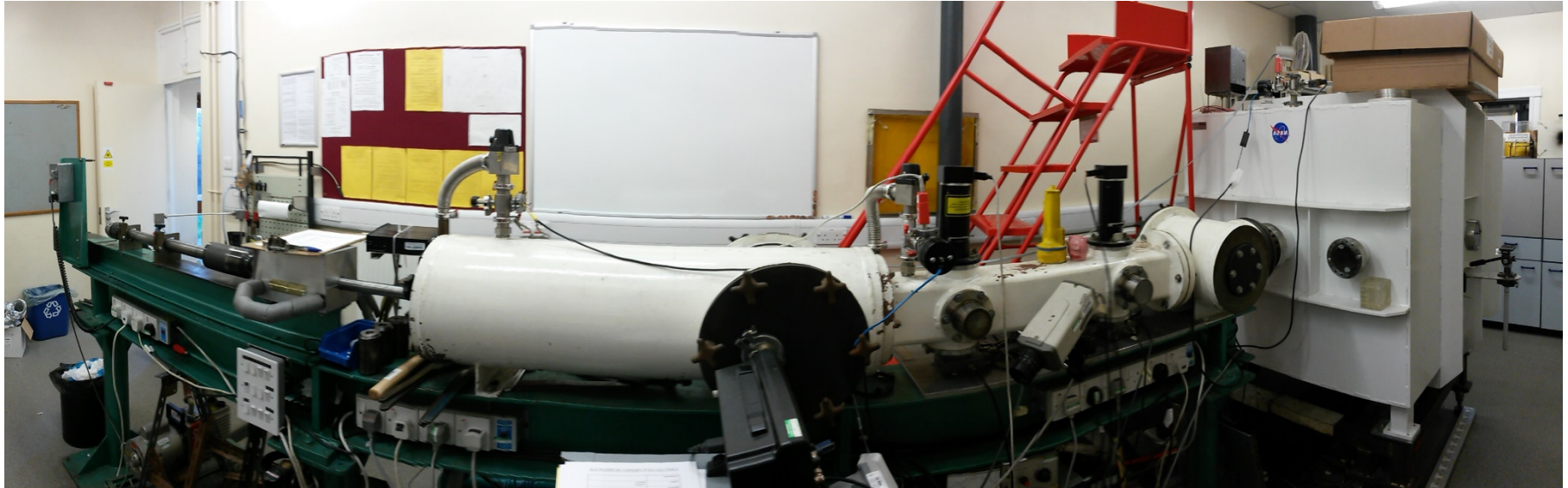
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Can the impact craters on these moons give indications to the ice thickness or the subsurface density?

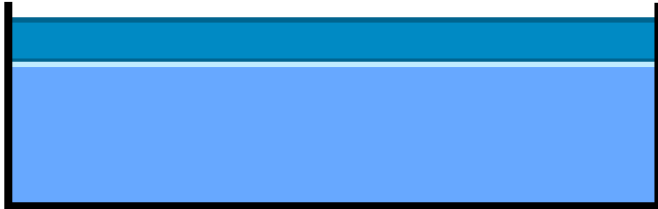
Can the impact craters on these moons give indications to the ice thickness or the subsurface density?

Laboratory Impact experiments into:
1: Layered ice/water targets
2: Spherical ice/water targets

Impact experiments at University of Kent



Layered ice targets



Ice over water



Ice over sand



Ice over basalt

Ice over water results at 5 km s⁻¹

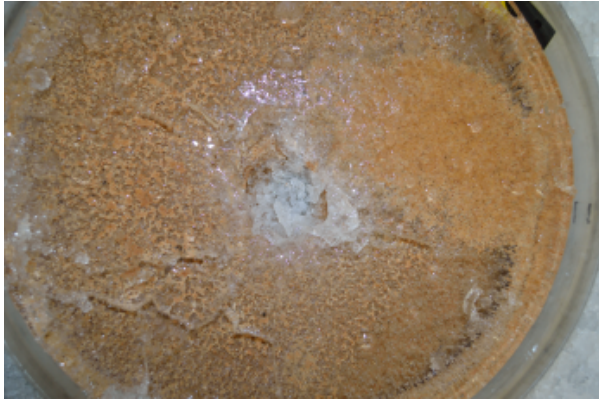


Diameter of all
targets = 210 mm



Increase in ice crust thickness 8,
16, 25 mm

Ice over sand at 5 km s⁻¹

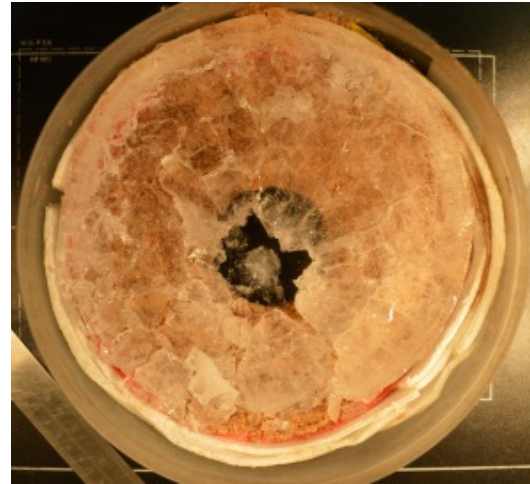


Diameter of all
targets = 210 mm



Increase in ice crust thickness 8,
13, 27 mm

Ice over basalt at 5 km s⁻¹

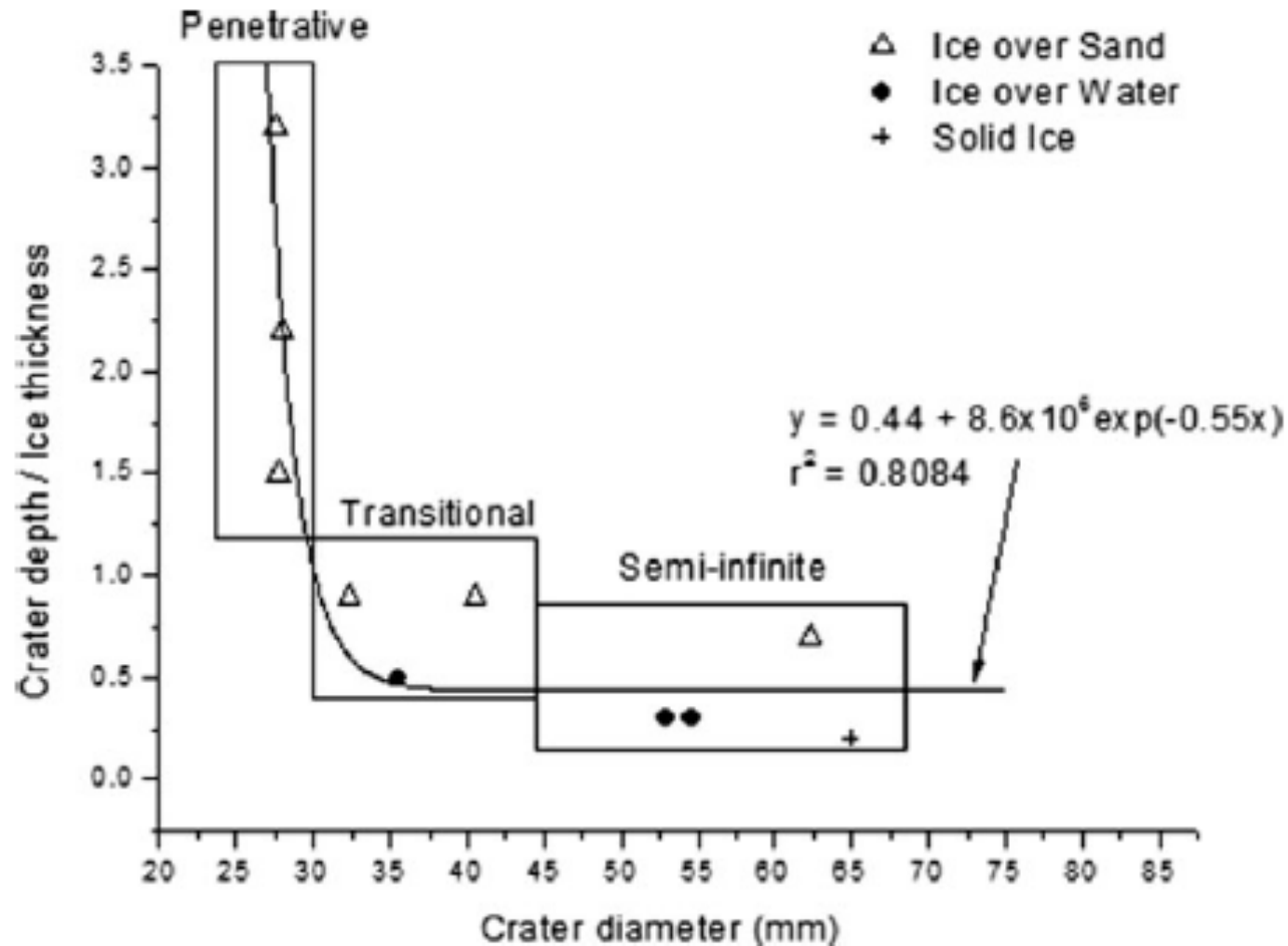


Diameter of all
targets = 210 mm



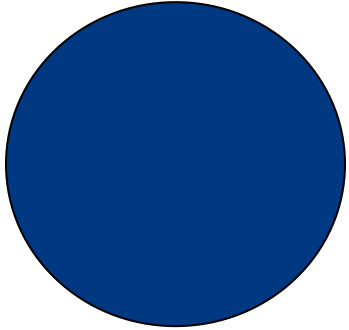
Increase in ice crust thickness
10, 15, 19 mm

Main results of layered ice targets

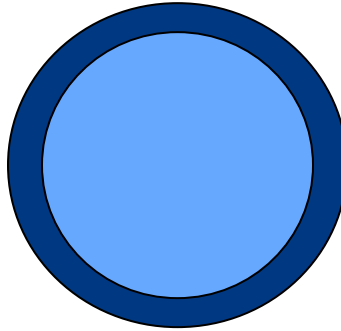


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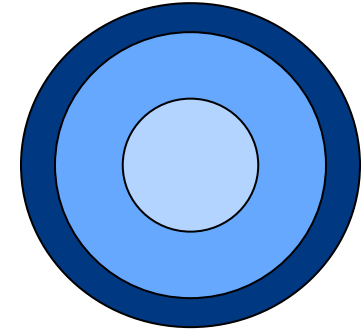
Liquid filled ice sphere targets!



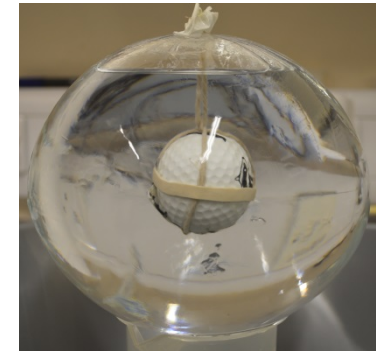
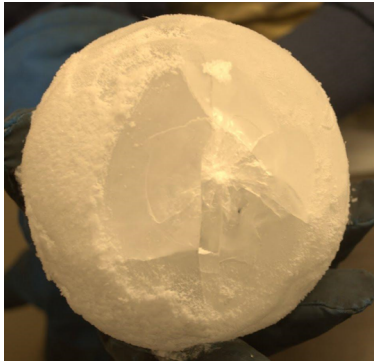
Solid Ice
Sphere



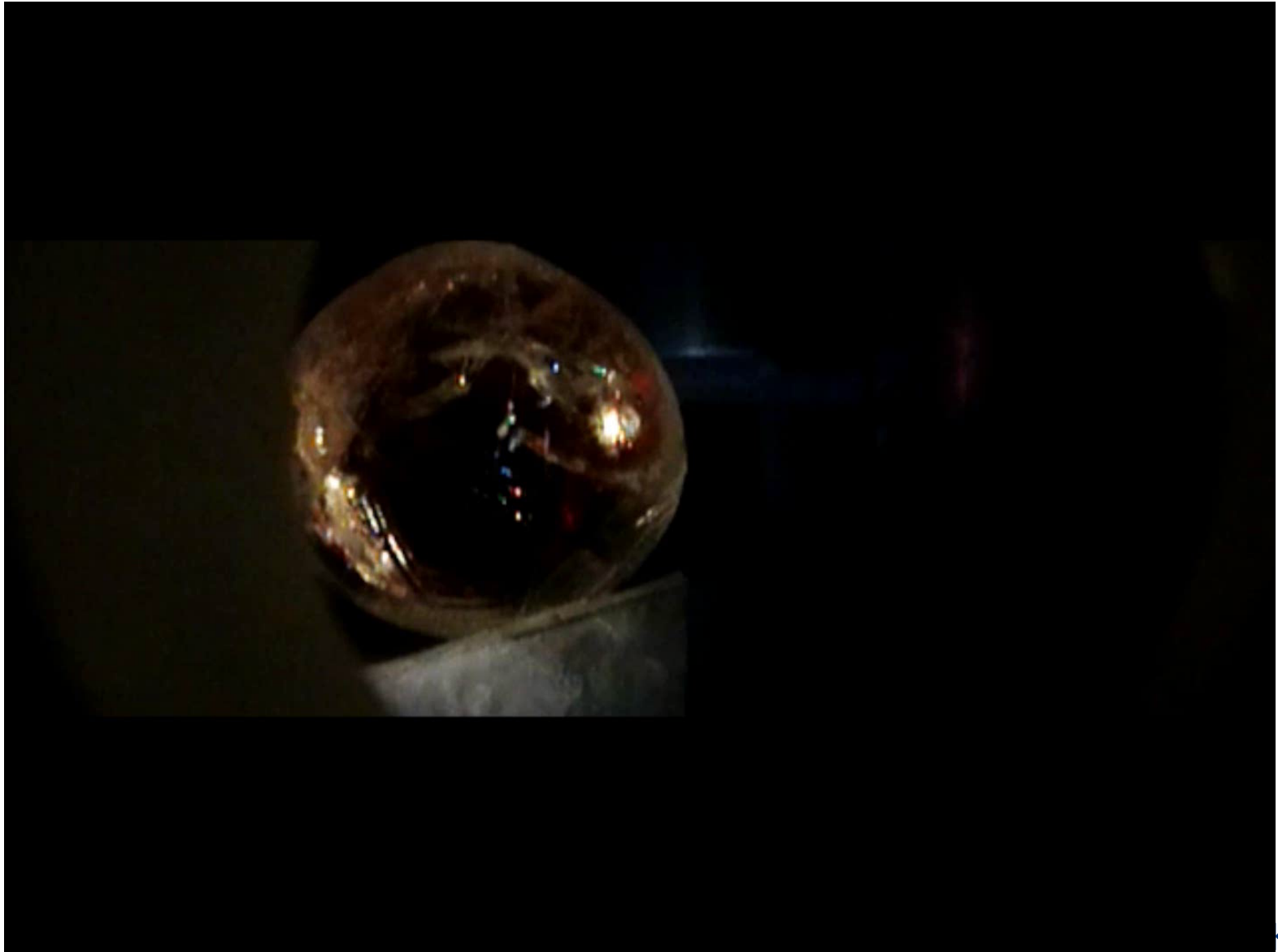
Ice sphere
with liquid
water centre



Ice sphere
with liquid
water and
solid core



Disruption of Icy Moons



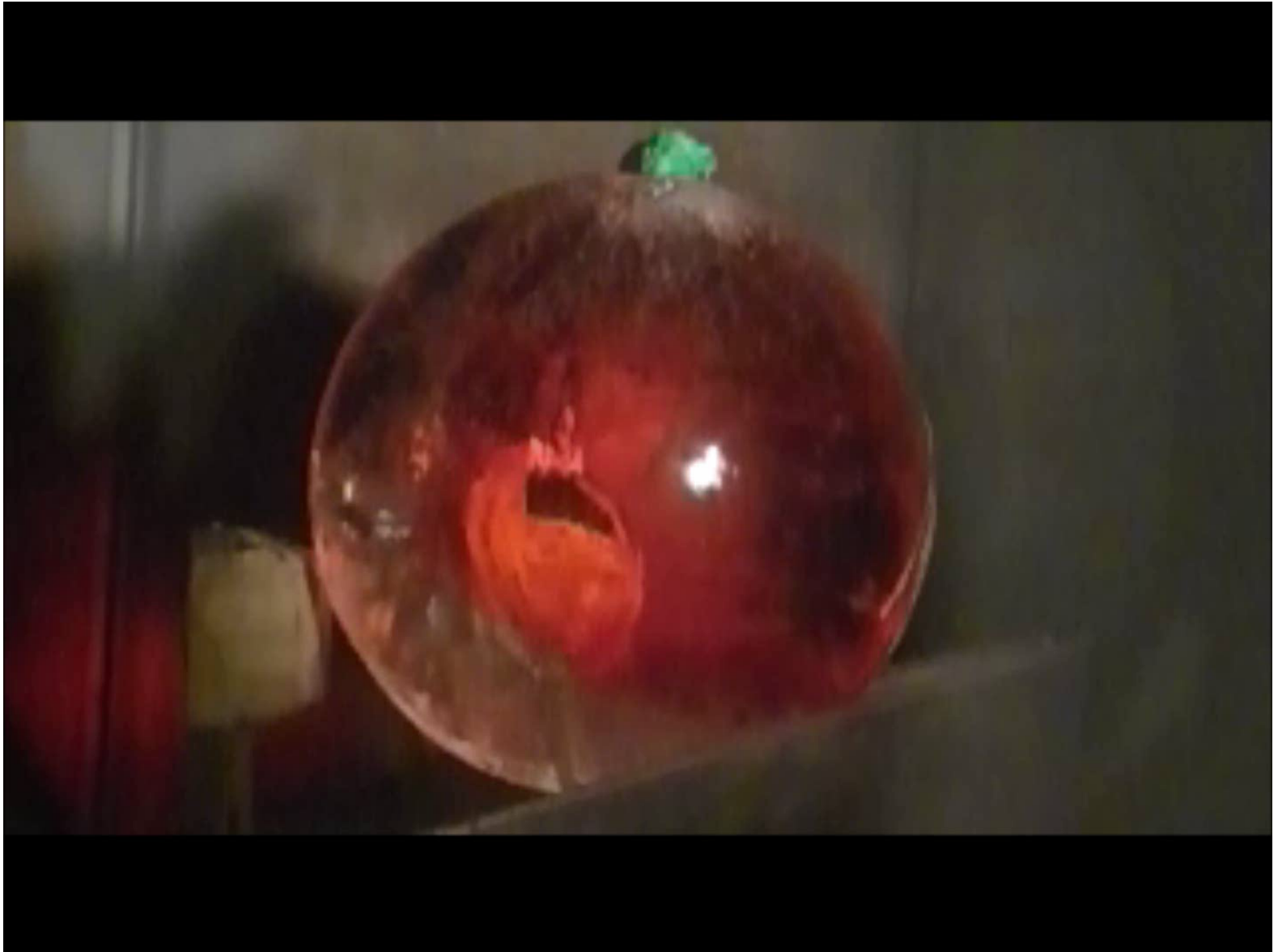
Disruption of Icy Moons

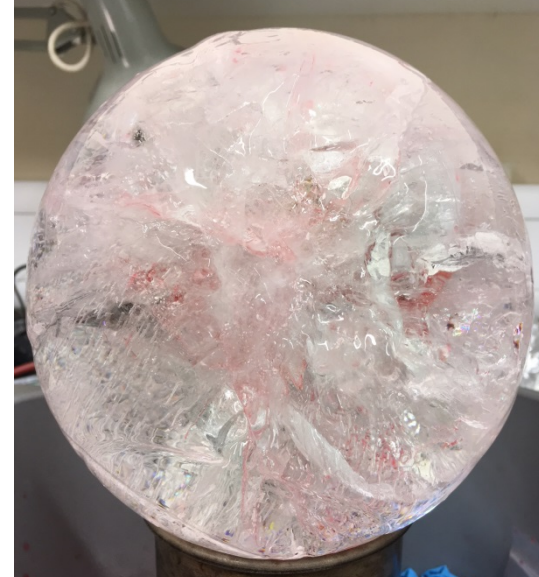


Formation of Fissures



Formation of Fissures





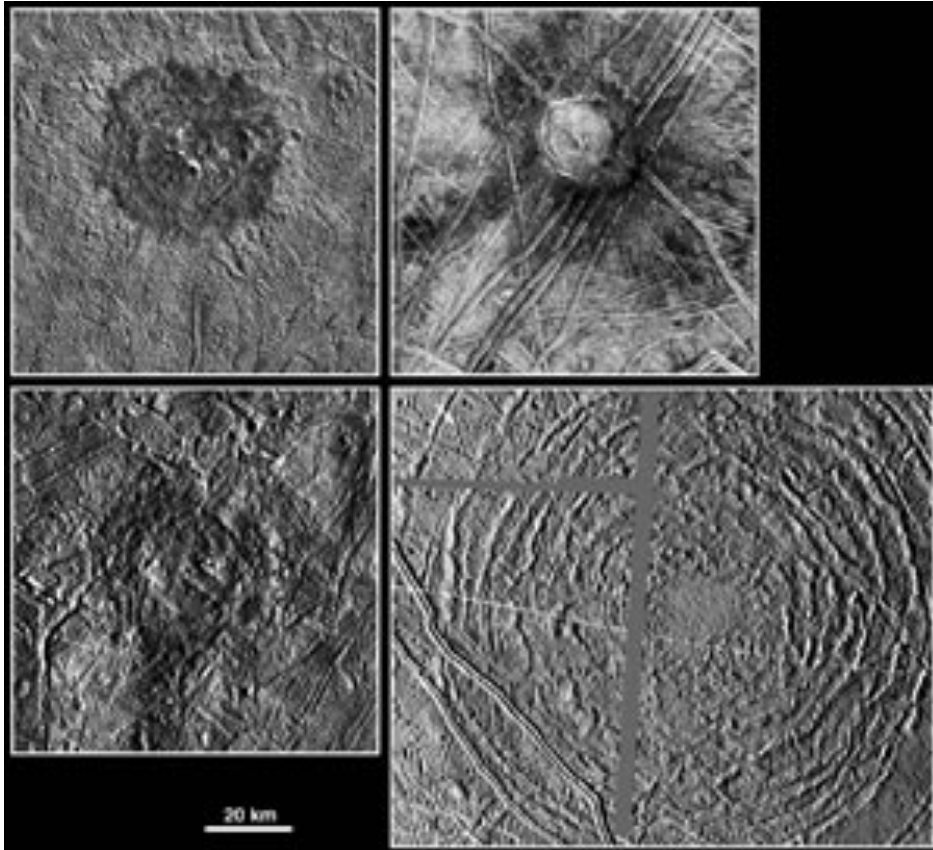
Main results of spherical targets - Fracturing

- Radial and circular fractures occur within 0.1 s of the impact.
- Fractures do not always extend the thickness of the ice crust
- Water does not appear to move into the fractures indicating that fissures may not be a result of impact related fracturing
- Large scale crater have an equivalent crater diameter to circumference ratio as some icy bodies.

On going work

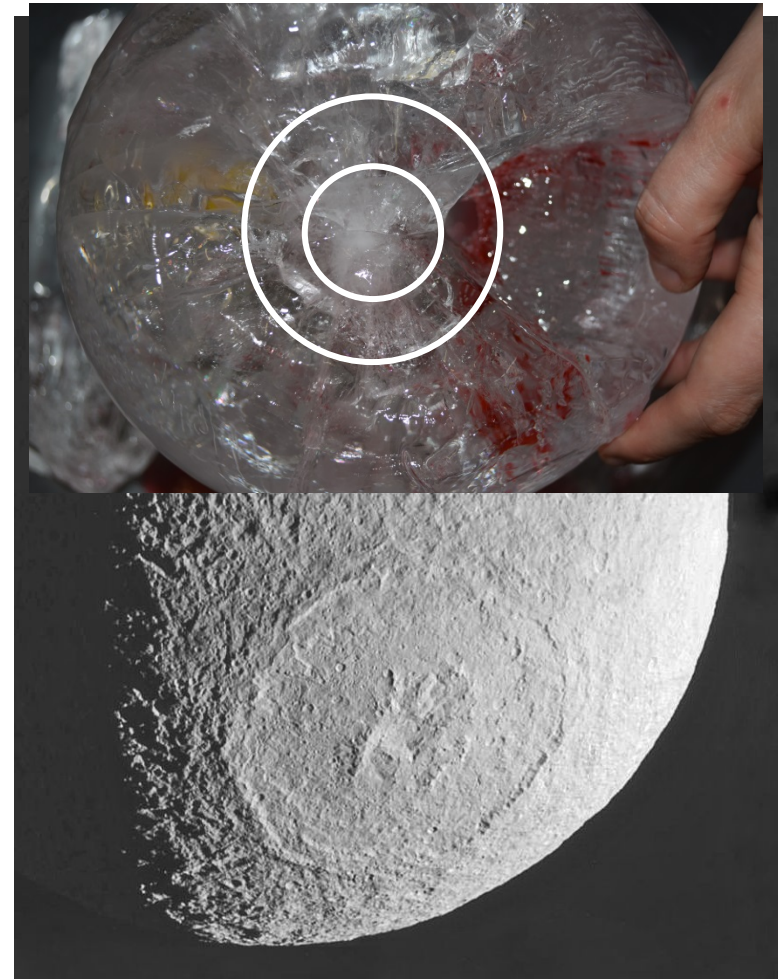
- Use the Vertical Gun set up to remove effects of horizontal impacts
- Continue investigating fracture formation within the ice crust

These results aim to aid in the search for suitable locations to search for evidence of life.



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Previous work of impacts into ice

- Ice composition (CO_2 , H_2O and NH_3)
- Projectile density
- Impact speed and angle
- Peak pressure
- Laboratory : Croft 1981; Kadono and Fujiwara, 1996; Arakawa, 1999; Arakawa et al., 2000; Burchell et al., 2001; Grey et al., 2001a; Koschny and Grun, 2001; Shrine et al., 2002; Grey et al., 2002; Dypvik et al, 2004; Kawakami et al, 2012; etc
- Hydrocode modelling : Senft and Stewart, 2008; Kraus et al, 2011; Fendyke et al, 2013 etc