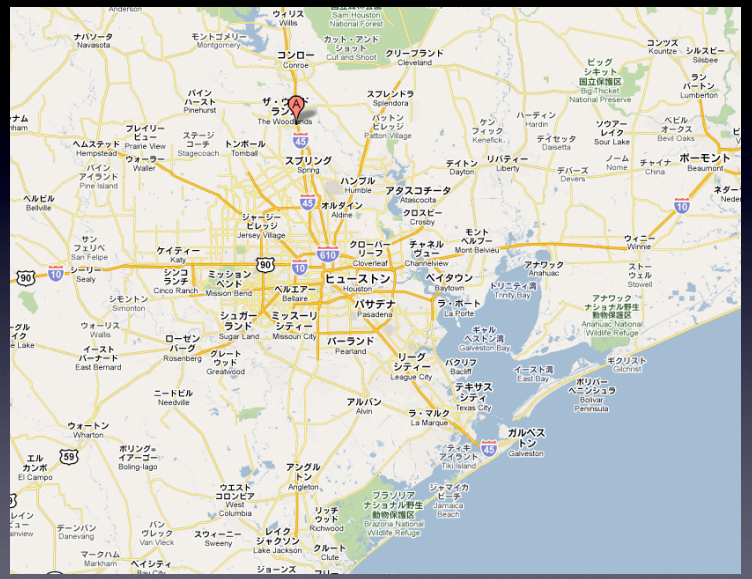
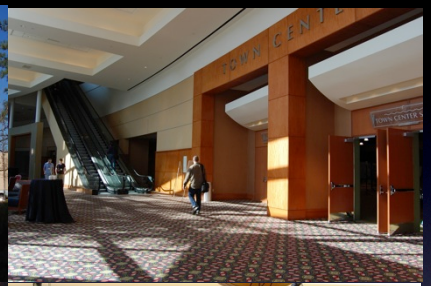
論文紹介セミナー15分発表　2010/4/22

Houston, Texas



Waterway Marriott Hotel



Topics

- Planetary Atmospheres
- Impacts
- Planetary Igneous Processes
- Planetary Differentiation
- Exobiology
- Cosmochemical Origins
- Early Solar System Chronology
- Interplanetary Dust Particles and Presolar/Solar Grains
- Small Bodies (including comets, asteroids, near-Earth objects)
- Outer Planets/Satellites/Rings
- Differentiated Bodies
- Mars Geomorphology
- Martian Geochemistry
- Moon
- Venus
- Mercury
- Material Analogs (including both physical and chemical)
- Environment Analogs (including terrestrial operationla analogs)
- Planetary Mission Concepts
- Instruments and Payload Concepts
- Education/Public Outreach
- A New Moon
- Characterizing Near-Earth Objects
- Water in the Solar System
- Other

研究報告

1. Hypervolocity Impact Experiments on Low Temperature Sand:Ice Targets [Simcox et al.]
2. Asteroids Without Ejecta [Housen & Holsapple]
3. Comparing Experimental and Numerical Results for Subsurface Failure Following Oblique Impacts into Planar Targets [Stickle & Schultz]
4. Large-scale Experiments to Determine the coefficient of Restitution for Meter-scale Granite Spheres [Durda et al.]

1. Hypervolocity Impact Experiments on Low Temperature Sand:Ice Targets [Simcox et al.]

- 砂氷混合物へ1mmステンレス球を5km/sで衝突
  - 砂：4種類（粒径分布、丸さが異なる）
    - 砂が浸るだけの水
  - 温度：255 K or 200 K

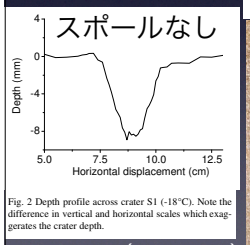
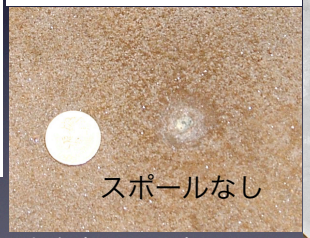


Fig. 2 Depth profile across crater S1 (-18°C). Note the difference in vertical and horizontal scales which exaggerates the crater depth.

JSC-Mars1（20-1000μm）@ 255 K

Fig 1. (a) Crater in S2 at 255 K (coin diameter = 22.5 mm). (b) Crater in S4 at 203 K, where the deeper central pit (arrowed) is surrounded by an incomplete spall zone (coin diameter = 24.5 mm).



丸砂（230-830μm）@ 255 K

珪藻土（<20μm）@ 204 K

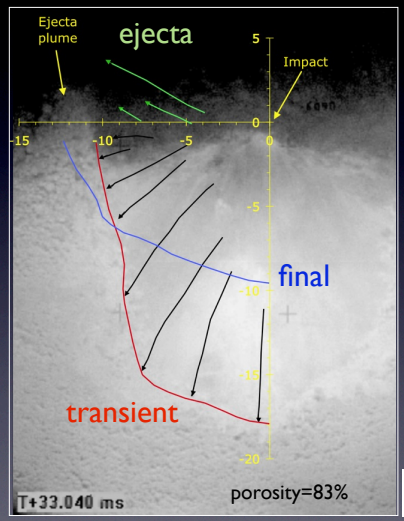
1. Hypervolocity Impact Experiments on Low Temperature Sand:Ice Targets [Simcox et al.]

Table 1. Crater sizes in this study.

		Sand	Temp. (K)	Vel. (km s^{-1})	Dia. (mm)	Depth (mm)	Spall Zone	Silicate Content
JSC-Mars1	20-1000μm	S1	255	5.08	32.5	7.33	No	72%
		S1	189±10	5.08	26.5	7.28	No	
丸砂	229-836μm	S2	255	5.05	28.0	10.14	No	84%
		S2	182±13	4.96	45.0	9.00	Yes	
細丸砂	27-585μm	S3	255	5.02	29.5	8.19	No	81%
		S3	188±14	5.13	31.0	7.16	No	
珪藻土	<20μm	S4	255	5.03	48.5	9.97	Yes	34%
		S4	203±14	4.97	46.5	9.77	Yes	

- 純氷上のクレーターより直径が小さい
- クレーター形状の依存性
  - 温度：低温では若干浅くなる
  - 粒子サイズ：小さいほど浅い
  - 砂含有量少：スポールが起こる
- 定量化は今後の課題

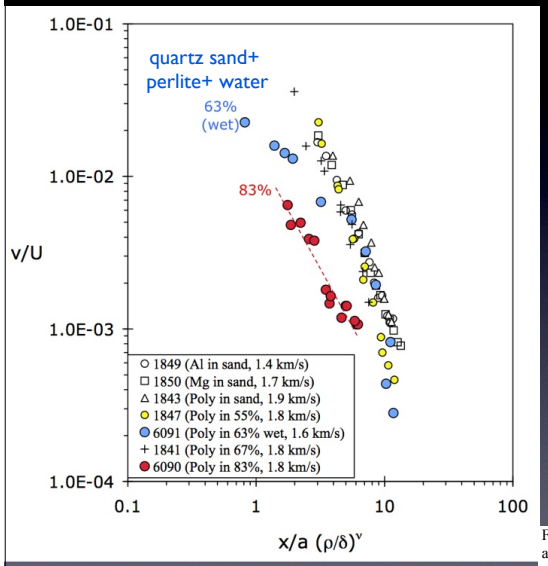
2. Asteroids Without Ejecta [Housen & Holsapple]



- quartz sand+ perlite、Porosity = 83%
- Poly弾(1.33g)、1.3km/s
- 掘削粒子流を自動検出
- クレーター形成
  - compactionが主（下向きの流れ）
  - shearing・ejectionは少ない

Figure 2. Material trajectories for an impact into a target with 83% porosity.

2. Asteroids Without Ejecta [Housen & Holsapple]

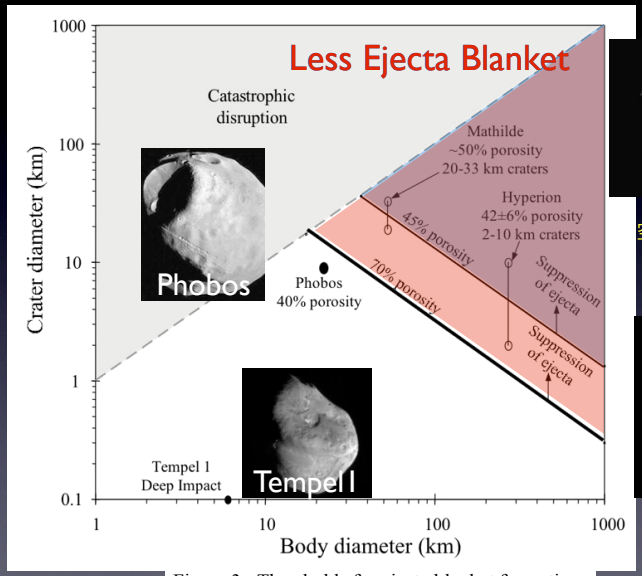


- 空隙率が大きいと放出速度が小さい
- 重力増大と伴に放出量減少 (Housen & Holsapple, 2003)

v：エジェクタ速度
U：衝突速度
x：衝突点からの距離
a：弾丸直径
δ：弾丸密度
ν：0.4

Figure 1. Ejection velocity vs launch position for sand and porous materials.

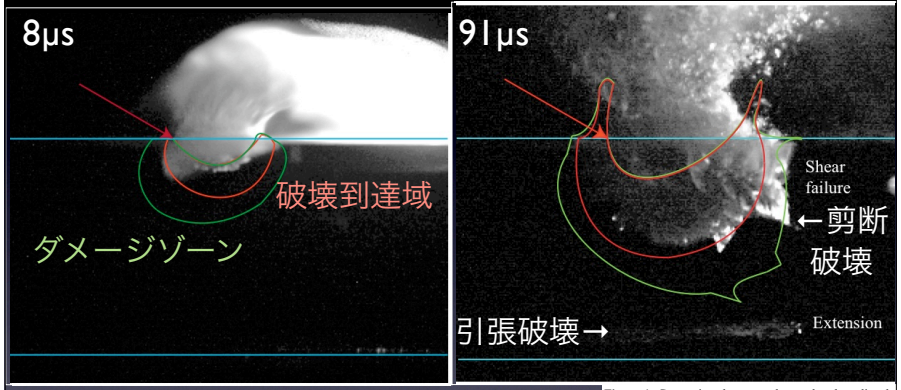
2. Asteroids Without Ejecta [Housen & Holsapple]



空隙率大、重力大
→ejecta少

Figure 3. Thresholds for ejecta blanket formation.

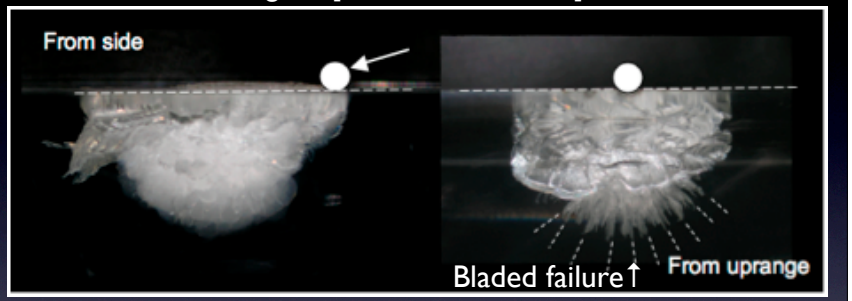
3. Comparing Experimental and Numerical Results for Subsurface Failure Following Oblique Impacts into Planar Targets [Stickle & Schultz]



- アクリルに衝突角30°でpyrex球を5.5km/sで衝突
- Hydro code: CTH
  - 完全には一致しない

Figure 1. Comparison between observed and predicted damage zone sizes. Impact by a Pyrex projectile at 5.5 km/s for a 30 degree impact: a) 8 μsec after first contact; b) 91 μsec after first contact, after damage zone finished growing. Though morphologically similar, CTH simulations cannot exactly reproduce the observed damage zones. The red line corresponds to D=1, and locations where conditions for failure have been met, while the green line shows the total extent of the damaged zone (0 < D < 1). Failure criterion is set to 5% strain to failure.

3. Comparing Experimental and Numerical Results for Subsurface Failure Following Oblique Impacts into Planar Targets [Stickle & Schultz]



- 弾丸による破壊の違い
  - Al球：弾丸方向に刃状亀裂、CTHと類似（剪断破壊のため）
  - Pyrex球：亀裂は分散

Figure 2. Linear failure planes along impact trajectory for impact of aluminum projectile into PMMA block. Bladed failure is much more apparent following impacts with Aluminum, while failure appears to be distributed following impact with Pyrex projectile. CTH models indicate blades are the result of shear failure.

4. Large-scale Experiments to Determine the coefficient of Restitution for Meter-scale Granite Spheres [Durda et al.]

- 大きな物体は小さなものより早くdissipateするか？（→数値計算）
  - 1m花崗岩球の振り子衝突（<2m/s）
  - 反発係数を測定

Figure 1. A 1-meter-diameter granite sphere suspended for the large-scale 'pendulum' experiments. Left: Placement of support strapping and lifting from forklift. Right: Sphere suspended in place for experiment with 1-meter scale bar and experiment run number marker shown.

Figure 2. Granite spheres in equilibrium position. Left: Headache balls low near the spheres. Right: Headache balls moved higher up to minimize sphere wobble after impacts.

4. Large-scale Experiments to Determine the coefficient of Restitution for Meter-scale Granite Spheres [Durda et al.]

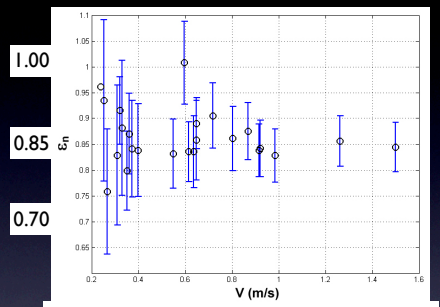


Figure 3. Coefficient of restitution as a function of impact speed for 1-meter diameter granite spheres.

- 反発係数の衝突速度依存性は見られない
  - Vi ~ 0.2 m/sの誤差大←画像分解能
    - ε ～0.85（@ Vi ＜ 2 m/s）