学会参加報告

☆ Workshop on Early Solar System Impact Bombardment
(Nov.19-20. 2008. Houston)

☆ International Workshop on the Warm Dense Matter
(March 16-19. 2009. Hakone)

☆ 40th Lunar and Planetary Science Conference (March 23-27. 2009. Houston)

黒澤 耕介 (東大 新領域 複雑理工 D3)

学会の概要

☆ Workshop on Early Solar System Impact Bombardment
(Nov.19-20. 2008. Houston)
- "Late Heavy Bombardment"は本当にあったのか？
- 月•隕石試料の年代測定 & "Nice model"

☆ International Workshop on the Warm Dense Matter
(March 16-19. 2009. Hakone)
- "Warm Dence Matter領域"での物性, 理論&実験のアプローチ

☆ 40th Lunar and Planetary Science Conference (March 23-27. 2009. Houston)
- 固体惑星系の大規模な学会

Workshop on Early Solar System Impact Bombardment

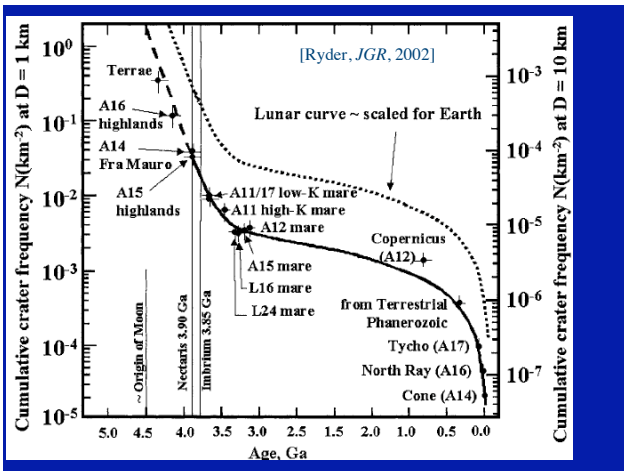
Abstract: http://www.lpi.usra.edu/meetings/bombardment2008/pdf/program.pdf

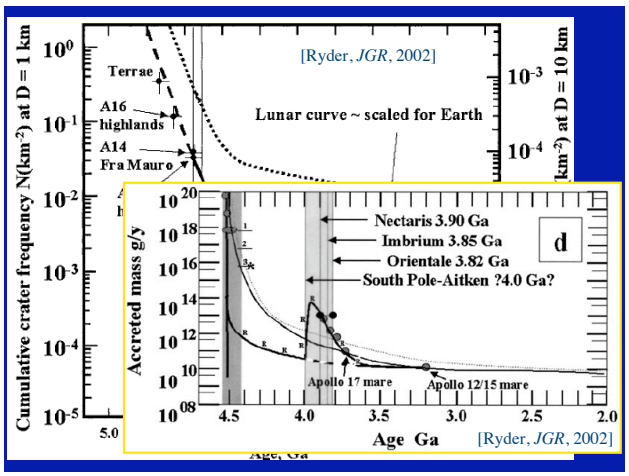
月・隕石試料分析関連

- Nectaris, Imbrium, Orientaleの年代解釈 汚染あり?なし？ [Bogard]
- 隕石試料の衝突年代も~4 Gyrにピークあり。 [Swindle & Kring]

Nice Model 関連

- 惑星移動によってMBAの分布も説明できる. [Minton & Malhotra]





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Nice Model 関連

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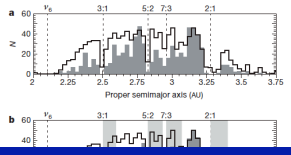
Vol 457|26 February 2009|doi:10.1038/nature07778 nature

LETTERS

A record of planet migration in the main asteroid belt

David A. Minton[1] & Renu Malhotra[1]

The main asteroid belt lies between the orbits of Mars and Jupiter, but the region is not uniformly filled with asteroids. There are gaps, known as the Kirkwood gaps, in distinct locations that are associated with orbital resonances with the giant planets[1]; asteroids placed in these locations will follow chaotic orbits and be removed[2]. Here we show that the observed distribution of main belt asteroids does not fill uniformly even those regions that are dynamically stable over the age of the Solar System. We find a pattern of excess depletion of asteroids, particularly just outward of the Kirkwood gaps associated with the 5:2, the 7:3 and the 2:1 Jovian resonances. These features are not accounted for by planetary perturbations in the current structure of the Solar System, but are consistent with dynamical ejection of asteroids by the sweeping of gravitational resonances during the migration of Jupiter and Saturn ~4 Gyr ago.



D. A. Minton & R. Malhotra, *Nature*, **457**, doi:10.1038/, 2009

Workshop on Early Solar System Impact Bombardment

問題点

- Nice Model と希ガスの関連は議論されていない。

Nice Modelでは氷天体 : 岩石天体 ~ 1 : 1

->地球にも大量の彗星が衝突したはず
彗星には大量の希ガスが含まれているはず
[Notesco & Bar-nun, *Icarus*, 2005]

->->地球大気に大量の希ガスが供給されてしまう!
[Marty & Meibom, *eEarth*, 2007]

Available online at www.sciencedirect.com
SCIENCE DIRECT
ELSEVIER
Icarus 175 (2005) 546–550
ICARUS
www.elsevier.com/locate/icarus

A ~25 K temperature of formation for the submicron ice grains which formed comets

G. Notesco, A. Bar-Nun *

Department of Geophysics and Planetary Sciences, Tel-Aviv University, Tel-Aviv 69978, Israel

Received 1 April 2004; revised 15 November 2004
Available online 12 January 2005

Abstract

Following the observations of ice grains in cometary comae and their size distributions, we reexamined experimentally our previous conclusion that the ice grains which agglomerated to form comet nuclei were formed at ~25 K. The suggestion of a ~25 K formation temperature was confirmed experimentally. Moreover, we suggest that these ice grains had to be of submicron size.

Keywords: Comets; Comets, origin; Ices

G. Notesco & A. Bar-nun, *Icarus*, **175**, 546-550, 2005.

Workshop on Early Solar System Impact Bombardment

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eEarth, 2, 43–49, 2007
www.electronic-earth.net/2/43/2007/

eEarth

Noble gas signature of the Late Heavy Bombardment in the Earth's atmosphere

B. Marty[1] and A. Meibom[2]

[1]Centre de Recherches Pétrographiques et Géochimiques, Nancy Universités, Nancy, France
[2]Muséum National d'Histoire Naturelle, Paris, France

Received: 27 June 2007 – Published in eEarth Discuss.: 10 July 2007
Revised: 26 September 2007 – Accepted: 26 September 2007 – Published: 8 October 2007

B. Marty & Meibom, *eEarth*, **2**, 43-49, 2007.

International Workshop on Warm Dense Matter

Warm Dense Matterとは?
-> 固体密度をもつ~10^4 K程度のプラズマ(~100 GPa)
>10km/s 衝突の衝突直下点はまさにこの領域!

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固体物理学とプラズマ物理学の中間

粒子間相互作用が無視できない
-> 多体系量子力学の議論が必要

理論的な物性推定は極めて困難 -> 高強度レーザー実験

International Workshop on Warm Dense Matter

超高速X線トムソン散乱分光法(自由電子によるX線散乱)

Ultrafast X-ray Thomson Scattering of Shock-Compressed Matter

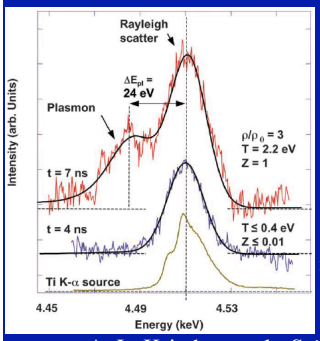
Andrea L. Kritcher,[1,2*] Paul Neumayer,[2] John Castor,[2] Tilo Döppner,[2] Roger W. Falcone,[3] Otto L. Landen,[2] Hae Ja Lee,[3] Richard W. Lee,[2,3] Edward C. Morse,[1] Andrew Ng,[2] Steve Pollaine,[2] Dwight Price,[2] Siegfried H. Glenzer[2]

Spectrally resolved scattering of ultrafast K-α x-rays has provided experimental validation of the modeling of the compression and heating of shocked matter. The elastic scattering component has characterized the evolution and coalescence of two shocks launched by a nanosecond laser pulse into lithium hydride with an unprecedented temporal resolution of 10 picoseconds. At shock coalescence, we observed rapid heating to temperatures of 25,000 kelvin when the scattering spectra show the collective plasmon oscillations that indicate the transition to the dense metallic plasma state. The plasmon frequency determines the material compression, which is found to be a factor of 3, thereby reaching conditions in the laboratory relevant for studying the physics of planetary formation.

A. L. Kritcher et al., *Science*, **322**, 69-71, 2008

International Workshop on Warm Dense Matter

超高速X線トムソン散乱分光法(自由電子によるX線散乱)



ピーク形状:
温度と電子密度の関数

nsの分解能で
温度, 電子密度の変化を推定可能

A. L. Kritcher et al., *Science*, **322**, 69-71, 2008

International Workshop on Warm Dense Matter

感想

海外の大型実験グループ:
実験家と理論家が強固に結びついている!

実験 (X線分光)
理論(流体計算)
理論(第一原理(ab initio)計算)　で１セット

日本における衝突現象の理論研究

P140-P006　会場: ポスター会場　時間: 5 月 18 日

SPH 法による氷天体の衝突計算

A Numerical Study of Collisions of Icy Bodies Using SPH Method

中島 美紀 [1]; 玄田 英典 [2]; 井田 茂 [3]
Miki Nakajima[1]; Hidenori Genda[2]; Shigeru Ida[3]

[1] 東工大・理・地惑; [2] 東工大・地惑; [3] 東工大・地惑
[1] Dept. Earth and Planet. Sci., Tokyo Tech.; [2] Earth and Planetary Sci., Tokyo Inst. of Tech.; [3] Dept. of Earth and Planetary Sci., Tokyo Inst. of Tech.

P140-P007　会場: ポスター会場　時間: 5 月 18 日

近似 Riemann Solver を使用した、非理想気体での SPH 法

Smoothed Praticle Hydrodynamics for real gas with approximate Riemann Solver.

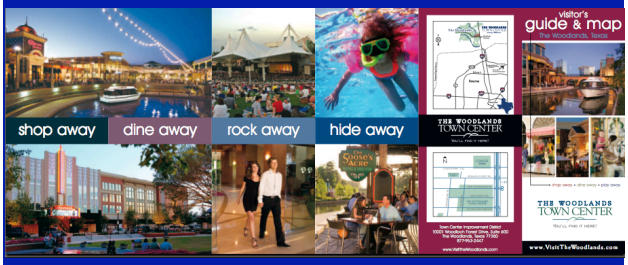
井田 茂 [1]; 玄田 英典 [2]; # 細野 七月 [3]
Shigeru Ida[1]; Hidenori Genda[2]; # Natsuki Hosono[3]

[1] 東工大・地惑; [2] 東工大・地惑; [3] 東工大・理工・地惑
[1] Dept. of Earth and Planetary Sci., Tokyo Inst. of Tech.; [2] Earth and Planetary Sci., Tokyo Inst. of Tech.; [3] Earth and Planetary Sciences, Titech

東工大 井田研究室が力を入れてきている様子

40th Lunar and Planetary Conference

今年から場所が変わりました



40th Lunar and Planetary Conference

Origin & Early Evolution of the Moon

- 高強度レーザー実験でGiant impact時のHf-W同位体平衡化を評価[Jacobsen et al.]
- Giant impact後の酸素同位体平衡化
  [Pahlevan & Stevenson vs Zindler & Jacobsen]

Impact

- 氷衛星上の多様なCrater形状を理解するには相変化を評価することが必要[Senft & Stewart]
- 氷 & 岩石混合物のPeak & Post Shock温度計測
  [Kraus & Stewart]

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 110, E03005, doi:10.1029/2004JE002305, 2005

Shock properties of H_2O ice

Sarah T. Stewart[1] and Thomas J. Ahrens
Lindhurst Laboratory of Experimental Geophysics, California Institute of Technology, Pasadena, California, USA

Received 10 June 2004; revised 28 October 2004; accepted 21 December 2004; published 18 March 2005.

[1] To understand the mechanics and thermodynamics of impacts on, and collisions between, icy planetary bodies, we measured the dynamic strength and shock states in H_2O ice. Here, we expand upon previous analyses and present a complete description of the phases, temperature, entropy, and sound velocity along the ice shock Hugoniot. Derived from shock wave measurements centered at initial temperatures (T_0) of 100 K and 263 K, the Hugoniot is composed of five regions: (1) elastic shocks in ice Ih, (2) ice Ih deformation shocks, and shock transformation to (3) ice VI, (4) ice VII, and (5) liquid water. In each region, data obtained at different initial temperatures are described by a single $U_S - \Delta u_p$ shock equation of state. The dynamic strength of ice Ih is strongly dependent on initial temperature, and the Hugoniot Elastic Limit varies from 0.05 to 0.62 GPa, as a function of temperature and peak shock stress. We present new bulk sound velocity measurements and release profiles from shock pressures between 0.4 and 1.2 GPa. We report revised values for the shock pressures required to induce incipient melting (0.6 ± 0.05, 1.6 ± 0.3 GPa) and complete melting (2.5 ± 0.1, 4.1 ± 0.3 GPa) upon isentropic release from the shock state (for T_0 = 263, 100 K). On account of the >40% density increase upon transformation from ice Ih to ices VI and VII, the critical shock pressures required for melting are factors of 2 to 10 lower than earlier predicted. Consequently, hypervelocity impact cratering on planetary surfaces and mutual collisions between porous cometesimals will result in abundant shock-induced melting throughout the solar system.

Citation: Stewart, S. T., and T. J. Ahrens (2005), Shock properties of H_2O ice, *J. Geophys. Res.*, *110*, E03005, doi:10.1029/2004JE002305.

S. T. Stewart & T. J. Ahrens,
JGR, **110**, E03005, doi:10.1029/2004JE002305, 2005

GEOPHYSICAL RESEARCH LETTERS, VOL. 35, L23203, doi:10.1029/2008GL035947, 2008

Click Here for Full Article

Shocked H_2O ice: Thermal emission measurements and the criteria for phase changes during impact events

Sarah T. Stewart,[1] Achim Seifter,[2] and Andrew W. Obst[2]

Received 9 August 2008; revised 28 October 2008; accepted 30 October 2008; published 6 December 2008.

S. T. Stewart et al.,
GRL, **35**, L23203, doi:10.1029/2008GL035947, 2008

応用先:
外縁天体の衝撃脱水による高密度化(~3 g/cc) ?