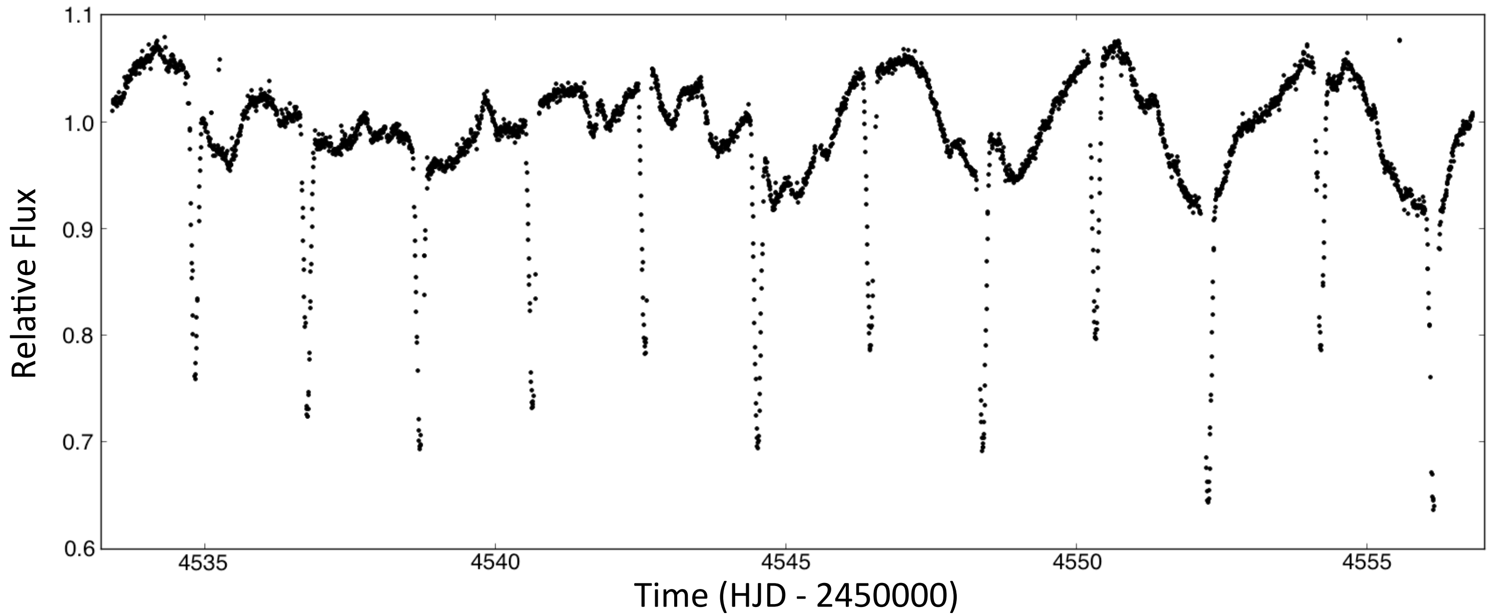
A UNIQUE LOW MASS ECLIPSING BINARY DISCOVERED BY CoRoT IN NGC2264

Ed Gillen, University of Oxford

- A Young Eclipsing Binary with a Circumbinary Disk?
  - CoRoT lightcurve shows out-of-eclipse variations in addition to stellar eclipses
    - Obscuration due to a warped and/or clumpy inner disk



- I present:
  - The eclipsing binary parameters
  - Outline evidence for the disk hypothesis
    - Star-Disk interaction
- Future work:
  - Modelling the system (binary stars + disk) to re-create multiband lightcurves

UNIVERSITY OF OXFORD

Tracing the Evolution of Dust in Protoplanetary Disks

The First Steps of Planet Formation*

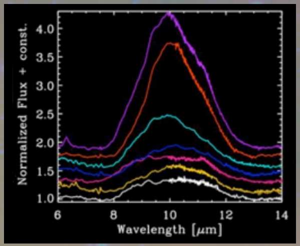
Isa Oliveira

Johan Olofsson, Klaus Pontoppidan, Ewine van Dishoeck, Jean-Charles Augereau, Bruno Merín

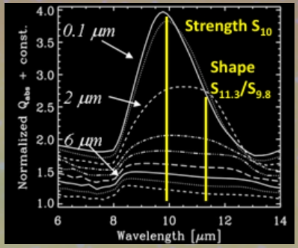
- Silicate features emitted by dust in the surface layers of protoplanetary disks
- The features at 10 and 20 µm
  - ✓ probed by Spitzer/IRS spectra
  - ✓ sensitive to dust size and composition
  - ✓ shed light on the progress of planet formation
- Investigation of dust mineralogy for sets of young stars surrounded by disks at different mean cluster ages and disk geometries -> how these parameters evolve

10 µm Silicate Feature

Observations



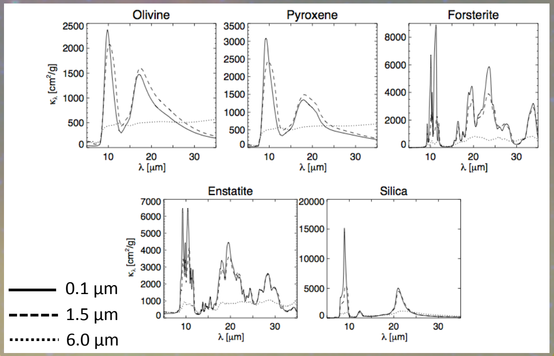
Models



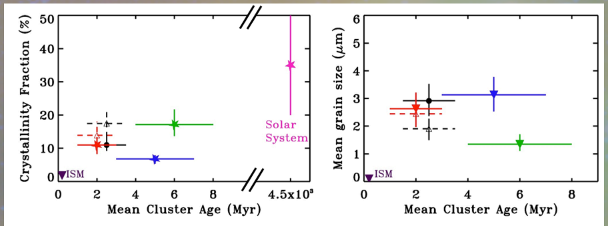
Spectral Decomposition

Goal is to infer composition and dominant grain size of emitting grains

Two temperatures, each composed of 3 amorphous (0.1, 1.5 and 6 µm) and 2 crystalline (0.1 and 1.5 µm) species



Evolution



Grain sizes and mean crystallinity fraction of a given star-forming region does not statistically change with time

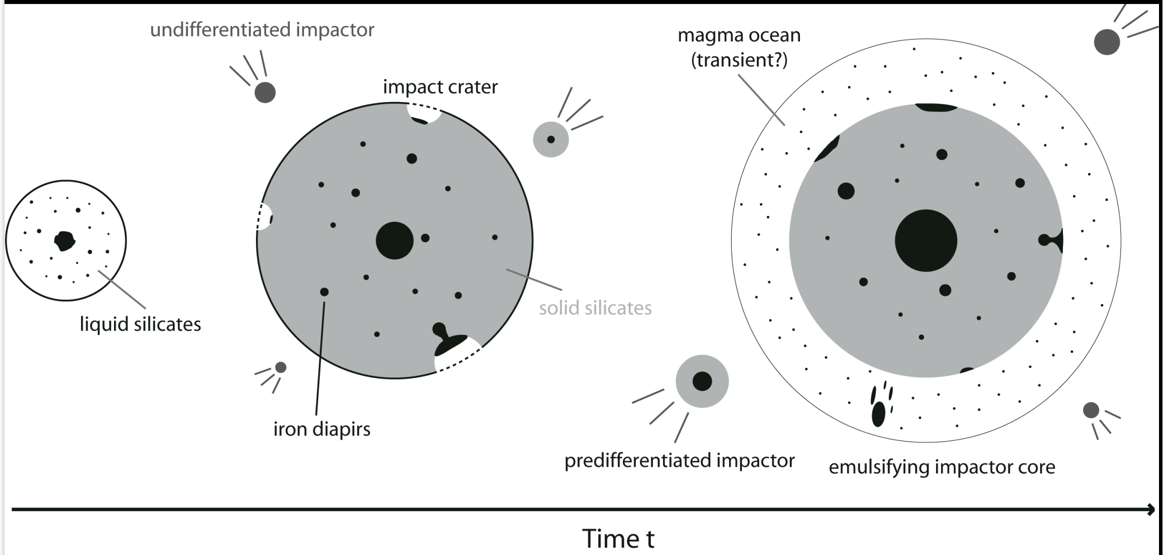
-> An equilibrium is reached very quickly (≤ 1 Myr), lasting until until disks dissipate

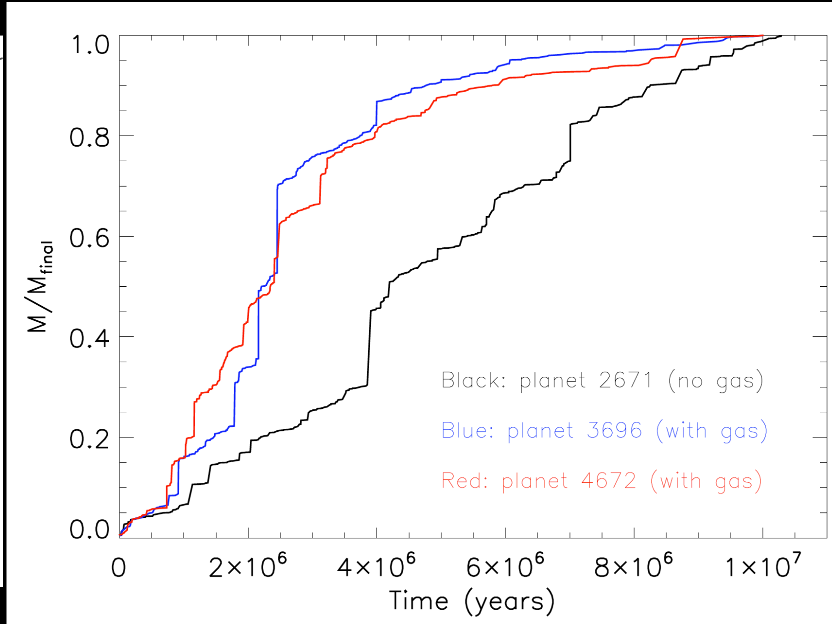
If planets are forming in disk mid-plane, no such equilibrium can take place there

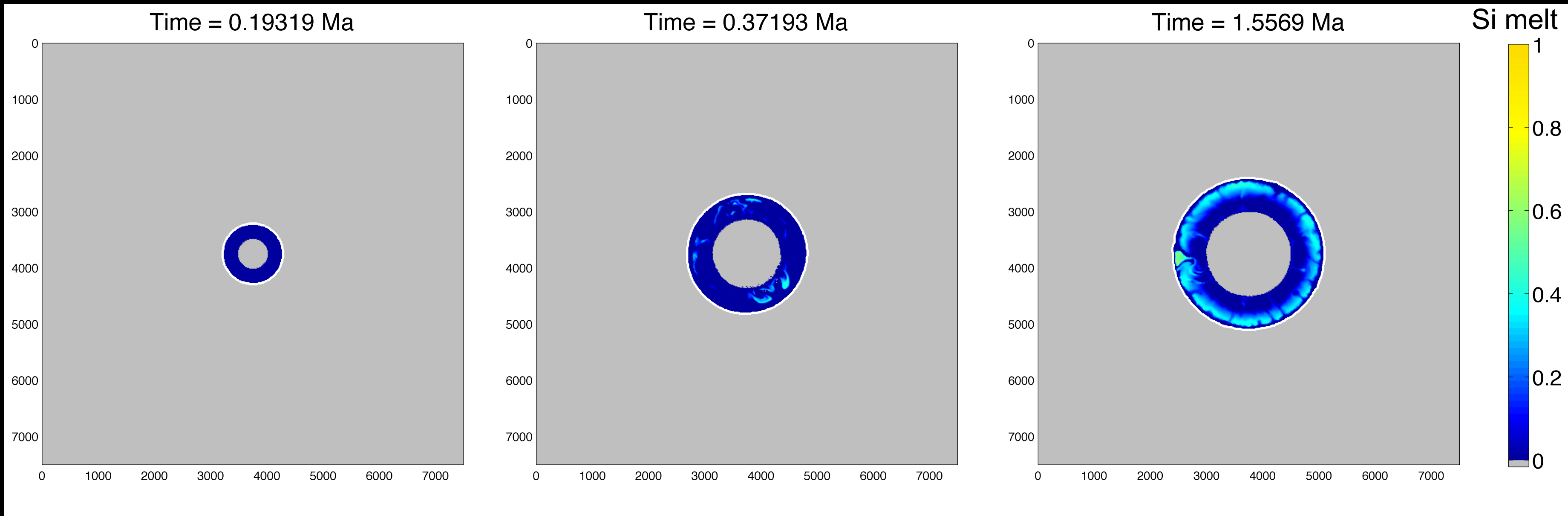
* P-03

Towards combined modeling of planetary accretion and differentiation

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich





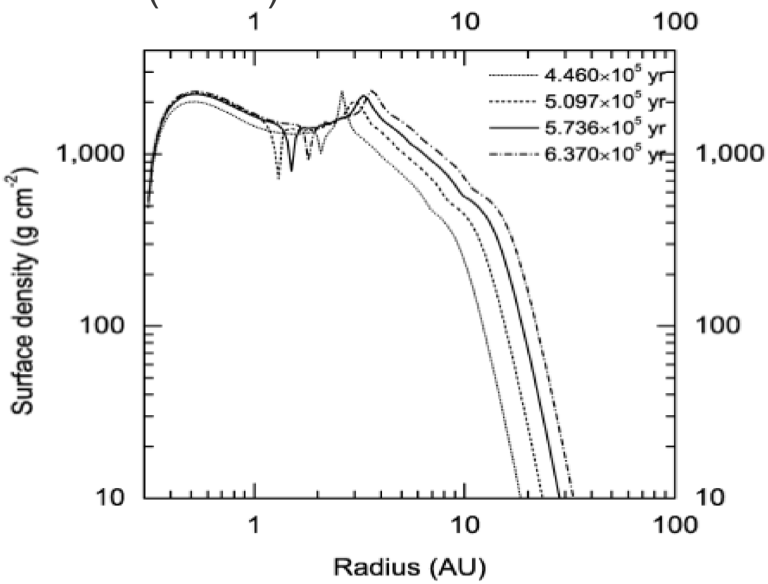


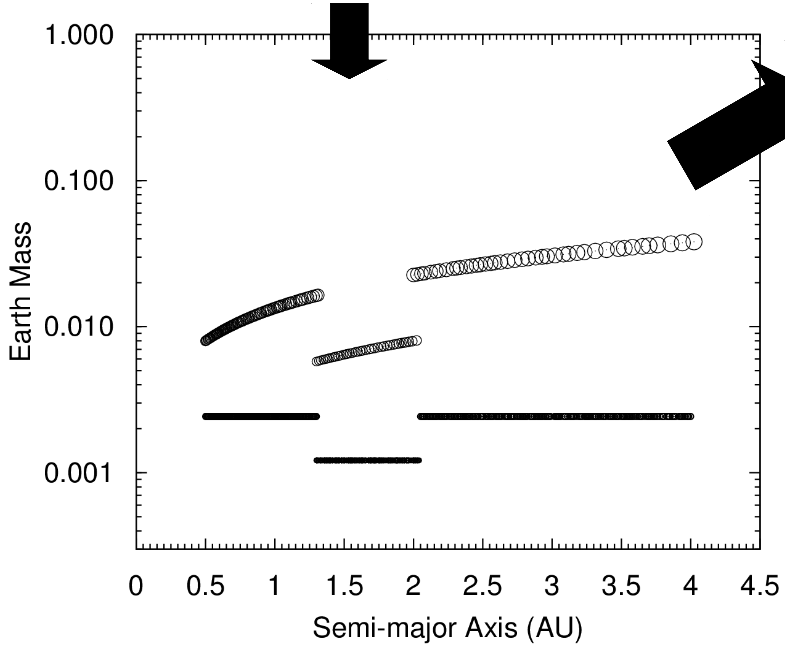
Can a local depletion in protosolar nebula explain the low mass of Mars?

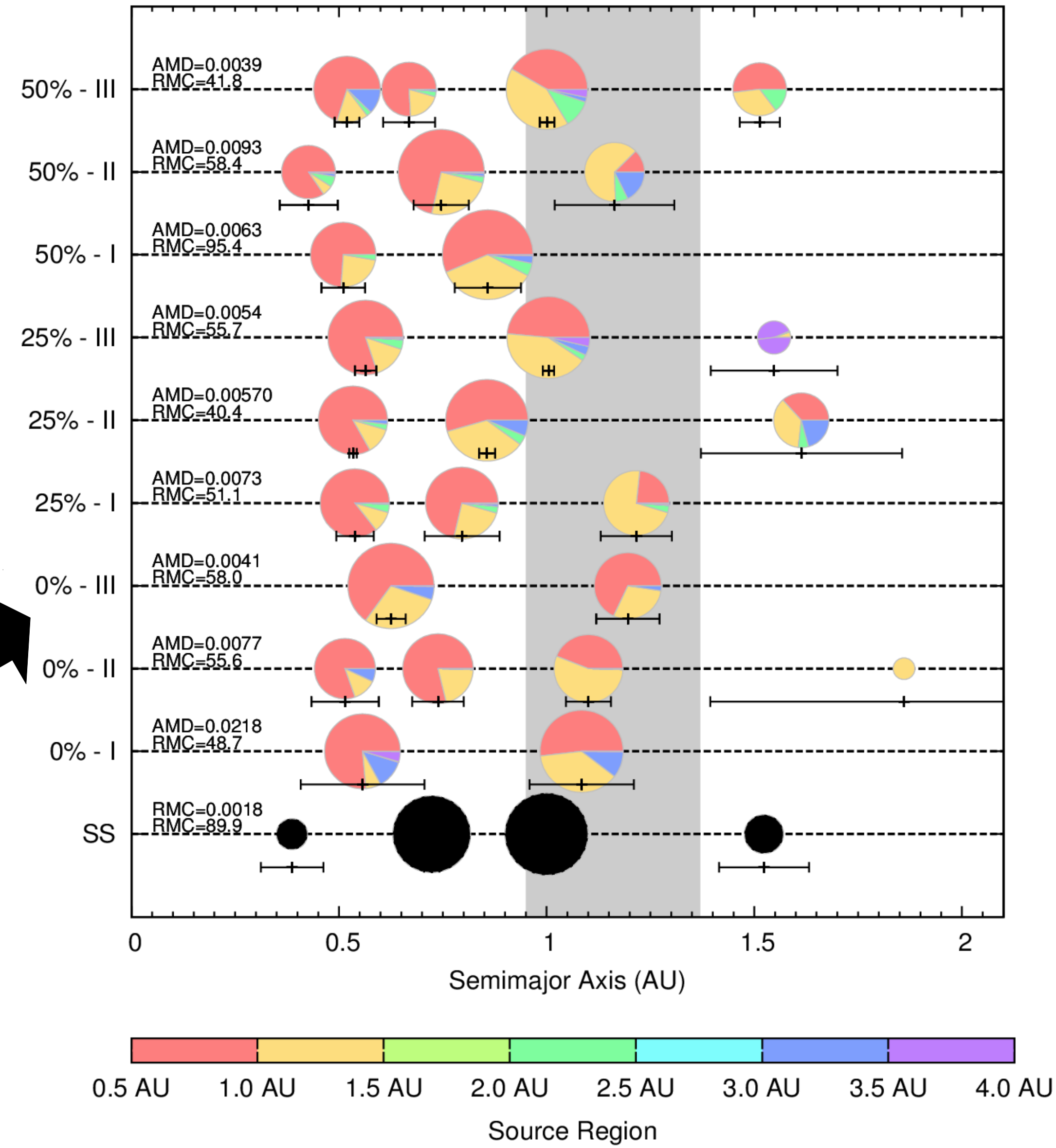
André Izidoro, Nader Haghighipour, Othon C. Winter and Masayoshi Tsuchida

São Paulo State University - UNESP - Grupo de Dinâmica Orbital & Planetologia, Brazil

Jin et al. (2008)







Wind shelter and Wind turbines on Mars.

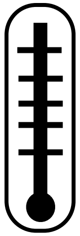
Mars is a windy planet

Enemy

Environmental problems

Solved

Extreme temperature



-60~20°C

Solved

High radiation

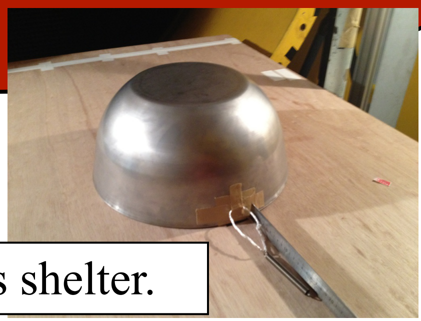
2 to 3 order greater than Earth

Unsolved

surface wind

seismo meter

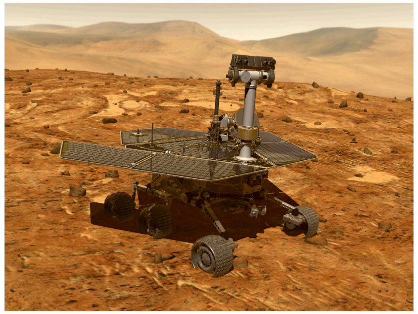
The key is wind shelter



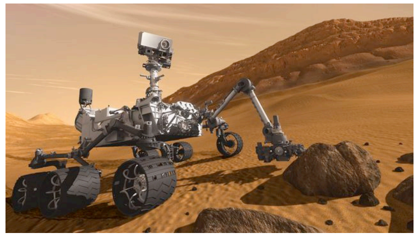
The designed torqueless shelter.

Friend

Solar panels



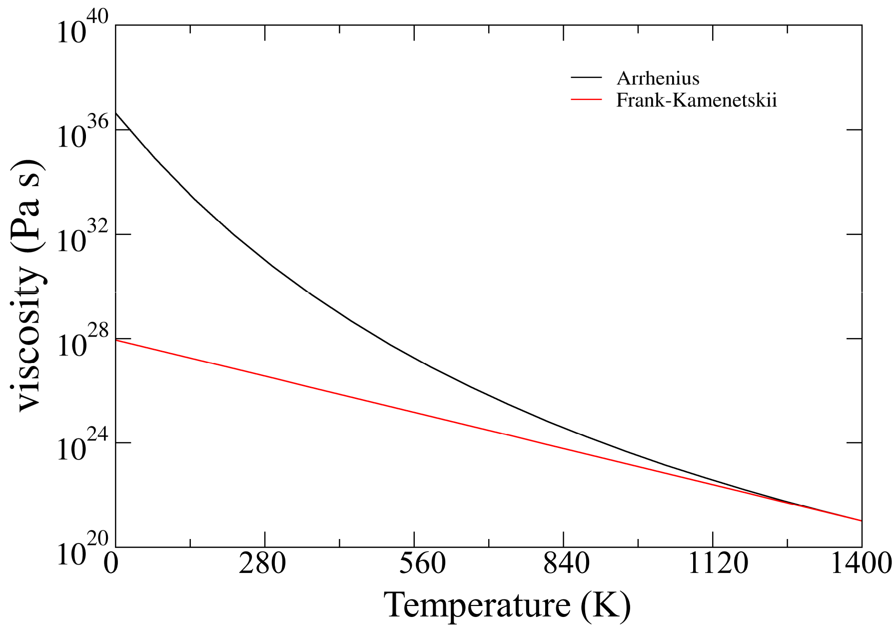
Nuclear batteries

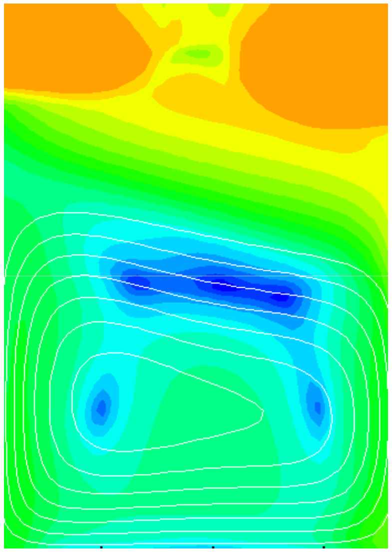


Can we use wind electricity?

Comparison of convection with Arrhenius viscosity and exponential viscosity: application to initiation of plate tectonics

Teresa Wong and Slava Solomatov, Washington University in St. Louis, St. Louis, MO, USA





How accurate is Frank-Kamenetskii approximation in predicting the lithospheric failure and subduction initiation?

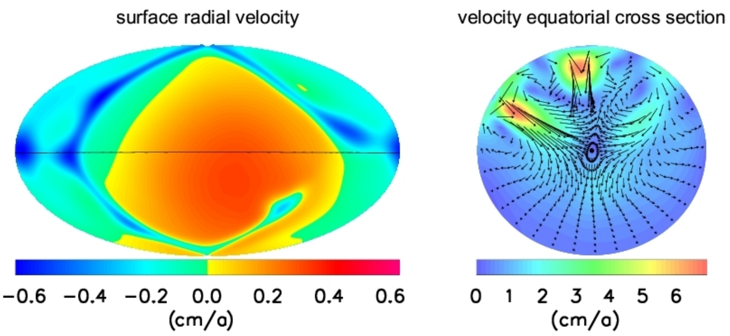
Implications of the lopsided growth for the viscosity of the Earth's inner core

Mizzon, H, hugau.mizzon@irap.omp.eu, Monnereau, M, marc.monnereau@irap.omp.eu

IRAP, Toulouse university, Toulouse, France

Two main seismic features characterize Earth's inner core: a North-South polar anisotropy and an East-West dichotomy of P-wave propagation properties (velocity and attenuation). Anisotropy is expected if shear deformation is induced by convective motions. However, translation has recently been put forward as the dominant mode of convection of the inner core (1, 2). Combined with a simple diffusive grain growth model, this mechanism is able to explain the observed seismic dichotomy, but not the bulk anisotropy. The source of anisotropy has therefore to be sought in the shear motions caused by higher modes of convection. Using a hybrid finite-difference spherical harmonics Navier-Stokes solver, this study investigates the interplay between translation and convection in a 3D spherical model. Three parameters act independently: viscosity, internal heating and outer core convection speed at the surface of the inner core. Particular attention has been paid to the implementation of realistic thermodynamic exchanges and permeable conditions at the inner core boundary. Our numerical simulations show the dominance of pure translation for viscosities higher than 10^{20} Pas. Translation is almost completely hampered by convective motions for viscosities lower than 10^{18} Pas. Between these bounds, translation and convection develop, but convective downwellings are restricted to the coldest hemisphere where crystallization occurs. On the opposite side, shear is almost absent, thereby allowing grain growth. We propose that the coexistence of translation and convection observed in our numerical models leads to a seismic asymmetry but localizes deformation only in one hemisphere.

(1) Monnereau et al., Science 2010. (2) Alboussiere et al., Nature 2010.

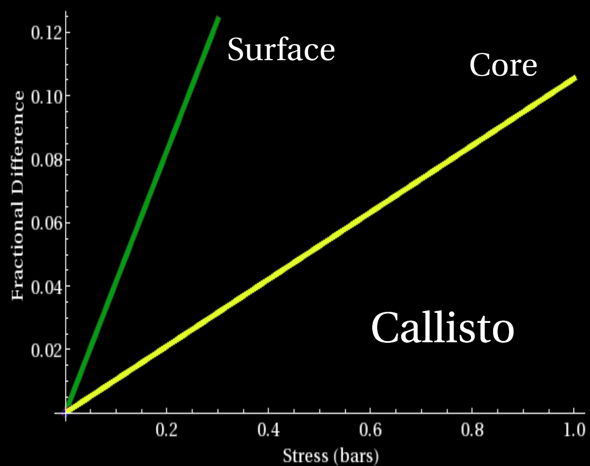


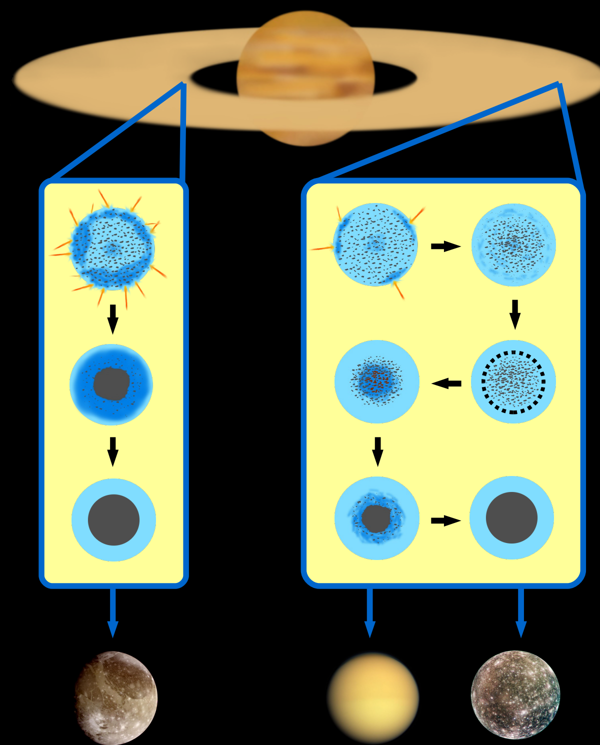
An equatorial cross-section of the simulation for a viscosity set to 10^{18} Pas shows that convective structures only develop in the hemisphere where iron enters the inner core. The thickness of the thermal boundary layer (TBL) depends on the orientation of the radial velocity at the ICB: inward (outward) motion tends to thicken (thin) the TBL. Where the TBL is thin it remains sub-critical which explains the absence of convective structure in one hemisphere. In the convecting hemisphere, crystals are deformed and remain small, whereas on the opposite hemisphere, the small strain rate would allow them to grow, thereby erasing their texture.

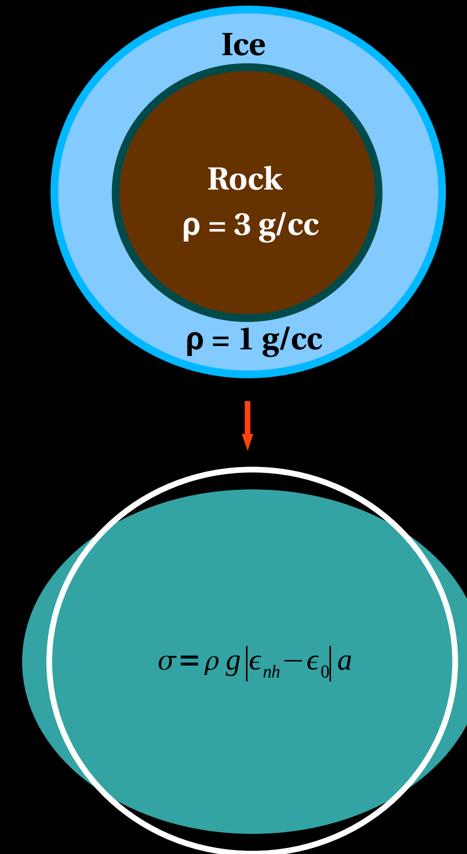
We formulated tidal decay lifetimes for hypothetical moons orbiting extrasolar planets with both lunar and stellar tides. Previous works neglected the effect of lunar tides on planet rotation, and are therefore applicable only to systems in which the moon's mass is much less than that of the planet. This work, in contrast, can be applied to the relatively large moons that might be detected around newly-discovered Neptune-mass and super-Earth planets. We conclude that moons are more stable when the planet/moon systems are further from the parent star, the planets are heavier, or the parent stars are lighter. Inclusion of lunar tides allows for significantly longer lifetimes for a massive moon relative to prior formulations. We expect that the semi-major axis of the planet hosting the first detected exomoon around a G-type star is 0.4-0.6 AU and is 0.2-0.4 AU for an M-type star.

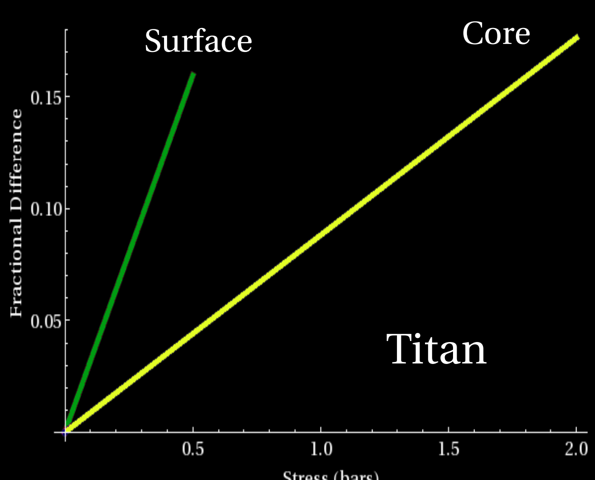
How does nonhydrostaticity affect the determination of icy satellites' moment of inertia?

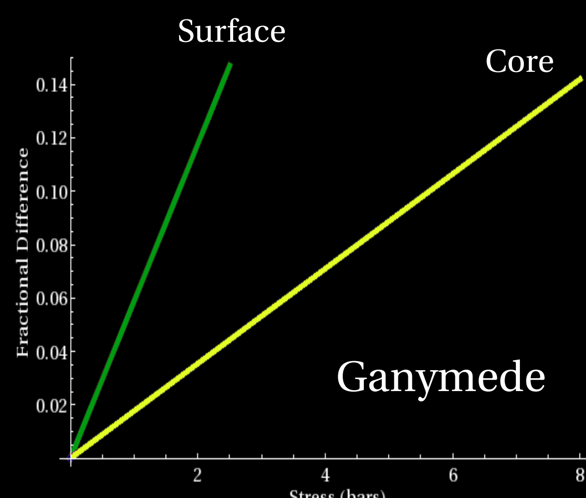
Peter Gao and David J. Stevenson
California Institute of Technology, USA

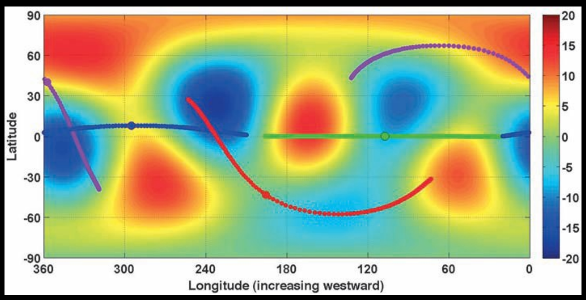








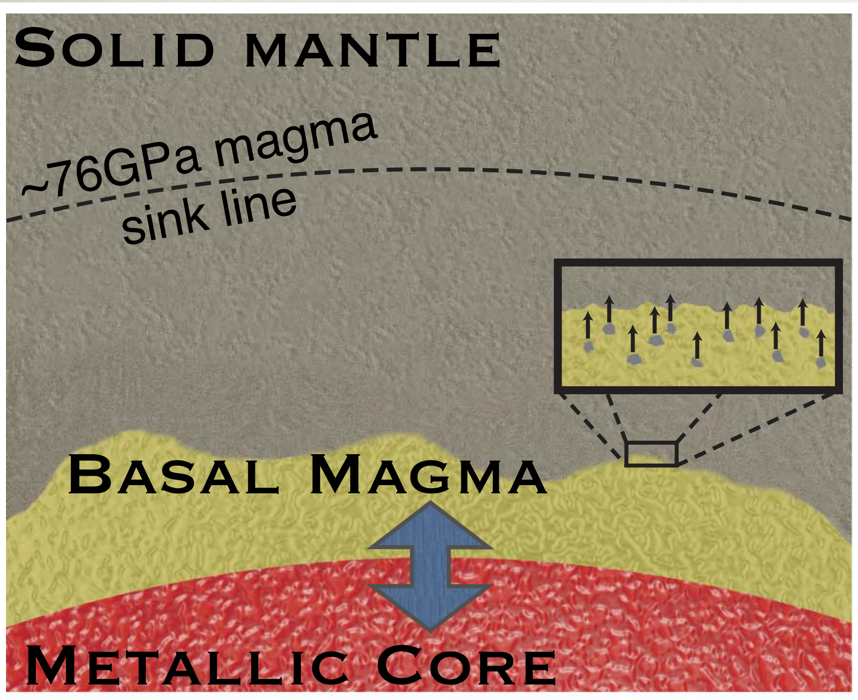




Titan geoid anomalies for $l > 2$
(Iess et al. 2010)

Deep dense magma & elements into the Core

Chemical reaction
between basal magma and molten core



- Silicon, Oxygen, Sulfur
- heat genic Potassium

into the Core?

Ryuichi Nomura
Tokyo Institute of Technology

The Rotational Period and the Surface Properties of Phaethon

Sherry Kang-Shian Pan[1] and Shinsuke Abe[1]
潘康嫻 & 阿部新助

[1] Institute of Astronomy, National Central University, 300 Jhongda Road, Jhongli, Taoyuan, 32001, Taiwan

Introduction

– *Apollo asteroid (3200) Phaethon*

- Phaethon has been known as the parent of the Geminids (e.g. Whipple, 1983)
- A brightening enhancement (Jewitt and Li, 2010)

→ Heterogeneity of the surface color

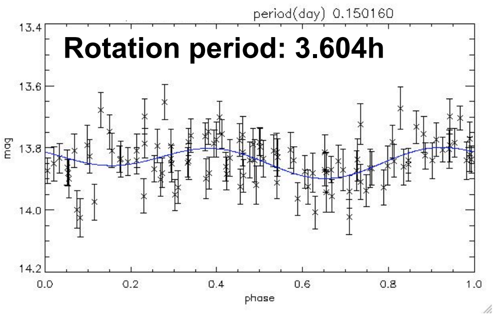
Observation

– *Optical Multi-colors Photometry*

- 0.81-m telescopes at Tenagra observatory in US (110° 52' 44.8"E, +31° 27' 44.4"N, H=1,312m)
- 1-m telescopes Lulin observatory in Taiwan (120° 52' 25" E, 23° 28' 07" N, H=2,862 m)
- 2011 November and 2012 February are discussed based on ~250 data set.

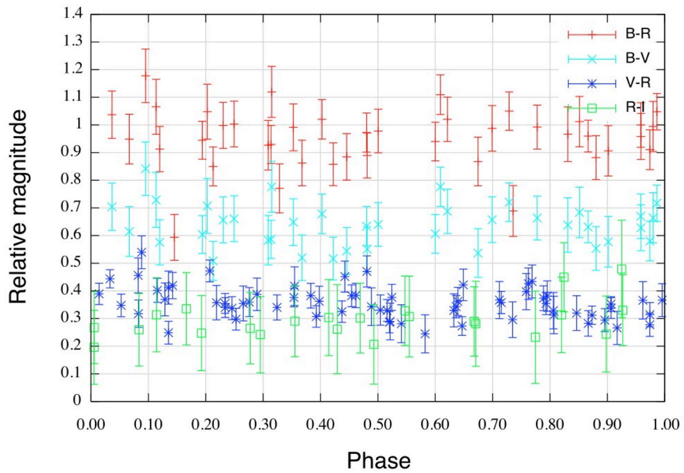
Rotation Period

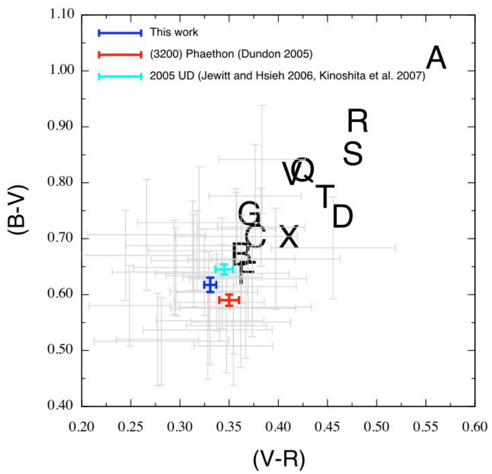
- 3.604 hours (Meech, K. J. et al. (1996) *ACM 1996, Abstract #42.*), and 7.208 hours (Kinoshita et al. (2012) in prep.)

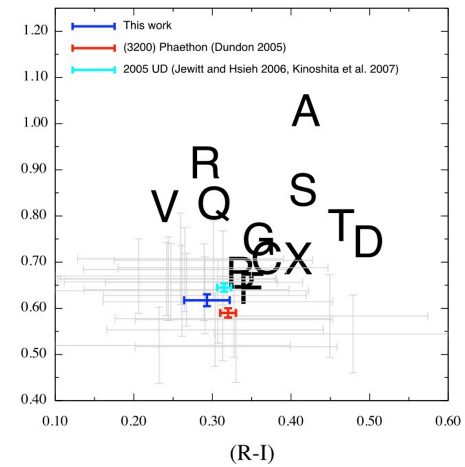


Color Information and Classified Type

- Phaethon color was comparable with F/B type asteroid.







Graduate Institute of Astronomy, NCU
國立中央大學天文研究所

The Effect of Lower Mantle Metallisation on the Dynamo Generated Magnetic Fields of Super Earths

Ryan Vilim, Sabine Stanley, Linda Elkins-Tanton

Recent work has shown that a host of materials commonly thought to be present in terrestrial planet mantles (e.g. $CaSiO_3$[1], Al_2SO_3[2], FeO[3]) will conduct electricity at the conditions present in the lower mantles of large, terrestrial exoplanets.

A solid, electrically conducting lower mantle layer should have a significant effect on any dynamo present in the planet, as magnetic field lines should be simultaneously anchored in the convecting fluid core, and the solid mantle. This should create a new source of shear for the dynamo to generate magnetic fields.

We use a numerical dynamo model to simulate the dynamo of terrestrial exoplanets and incorporate a conducting mantle layer. We study the effect the conductivity of the layer, and the inner core size has on observable field.

In all cases, a conducting lower mantle increases the internal field strength significantly, due to the presence of a new way to shear magnetic fields in the core.

We find that the observable effects of a conducting mantle layer are most pronounced in planets with a large solid inner core, where the observable magnetic field becomes weaker as the conductivity of the mantle is increased. Conversely, we find that in models with a small solid inner core the observed magnetic field becomes modestly stronger in the conducting mantle layer models.

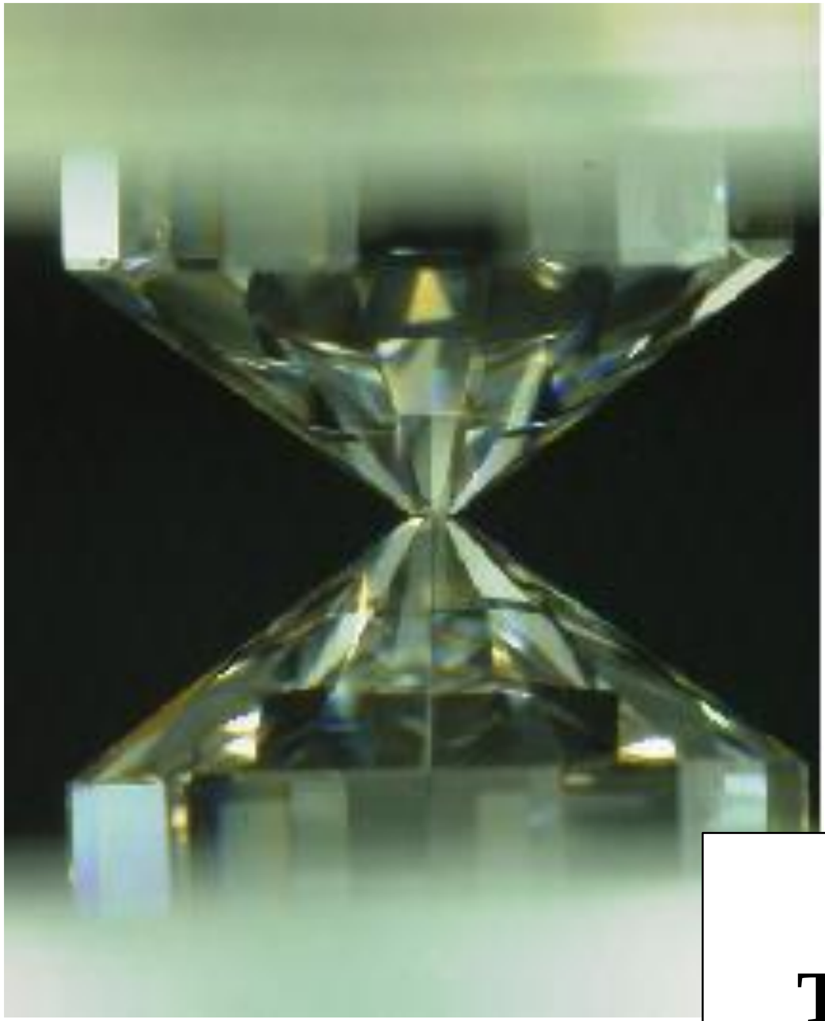
We will present the results of our models as well as a detailed explanation of the mechanism behind the observed effects.

[1] Tsuchiya, T. (2011). Prediction of a hexagonal SiO_2 phase affecting stabilities of MgSiO3 and $CaSiO_3$ at multimegabar pressures. *PNAS,* 108, 1252-1255

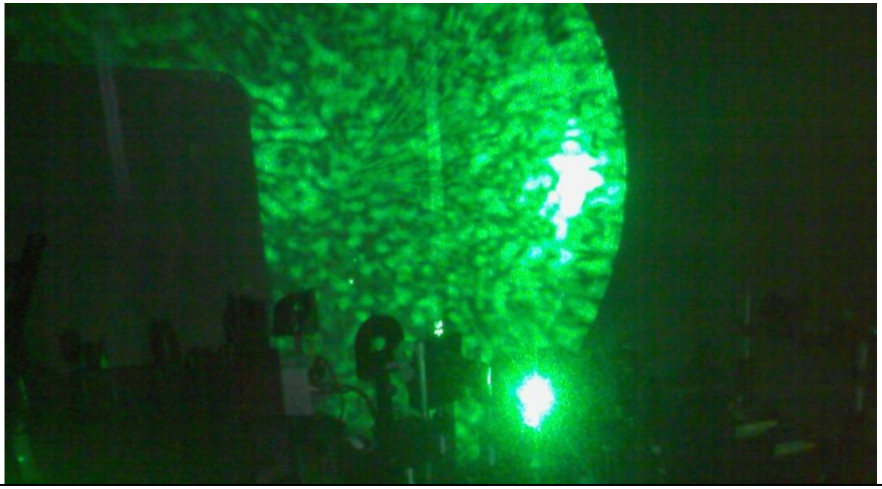
[2] Nellis, W. J. (2011). Metallic liquid hydrogen and likely Al_2O_3 metallic glass. *The European Physical Journal Special Topics*, 196, 121–130

[3] Ohta, K., Cohen, R. E., Hirose, K., Haule, K., Shimizu, K., and Ohishi, Y. (2012). Experimental and Theoretical Evidence for Pressure-Induced Metallization in FeO with Rocksalt-Type Structure. *PRL*, 108, 026403

Sound velocity of $CaSiO_3$ perovskite under ultrahigh-pressures



- Experimental measurements of sound velocity under high-pressure.
- Discussions of the structure of the earth's mantle.

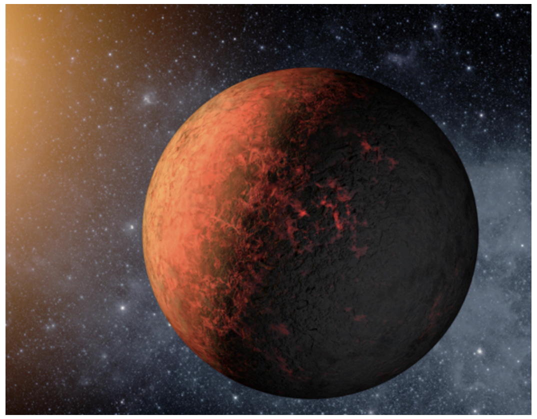


KUDO Yuki, HIROSE Kei,

Tokyo Institute of Technology

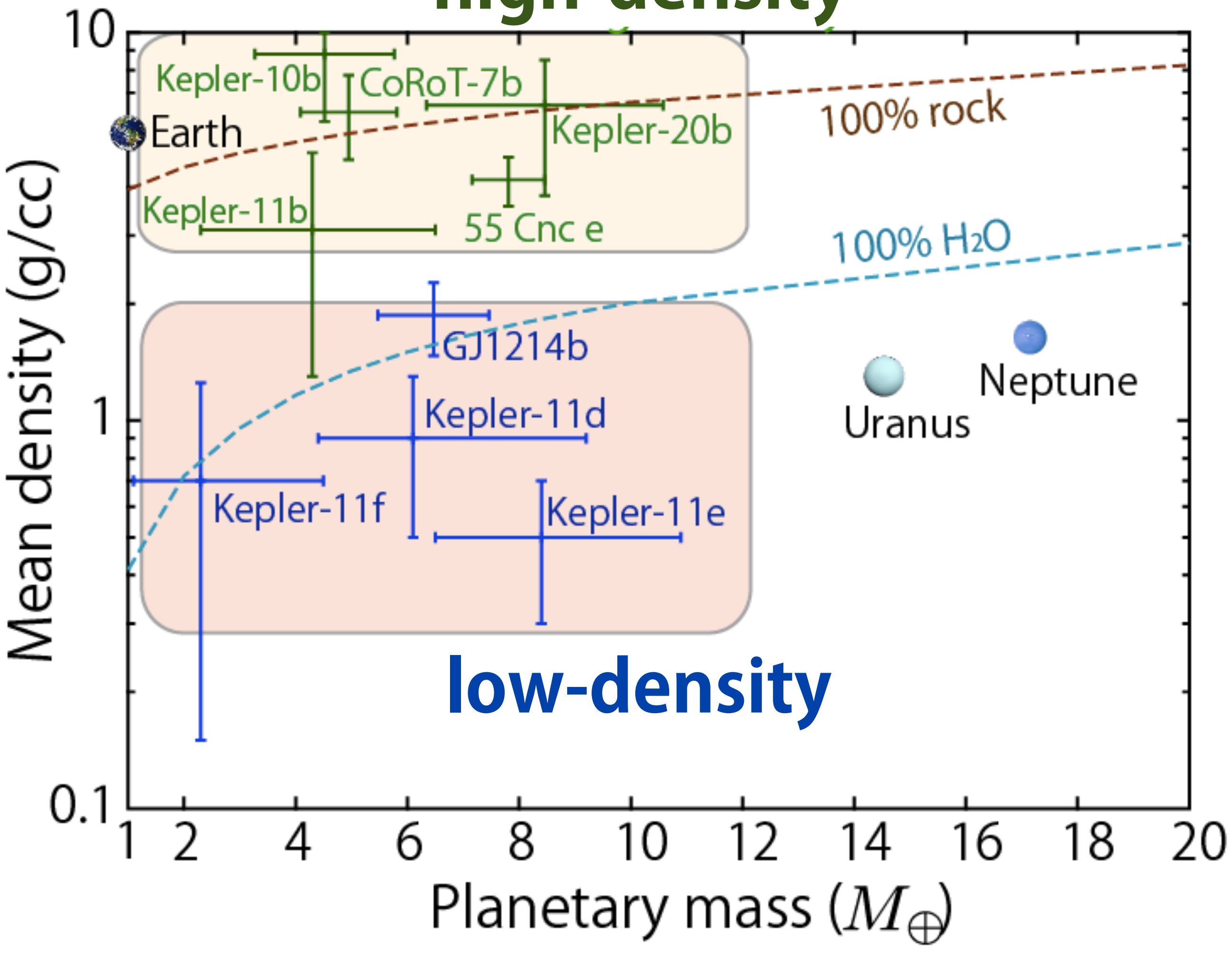
On the Accretion of Atmospheres Onto Super-Earths

Yasunori Hori
(National Astronomical Observatory of Japan)
(Collaborators) : M. Ikoma, D.N.C.Lin

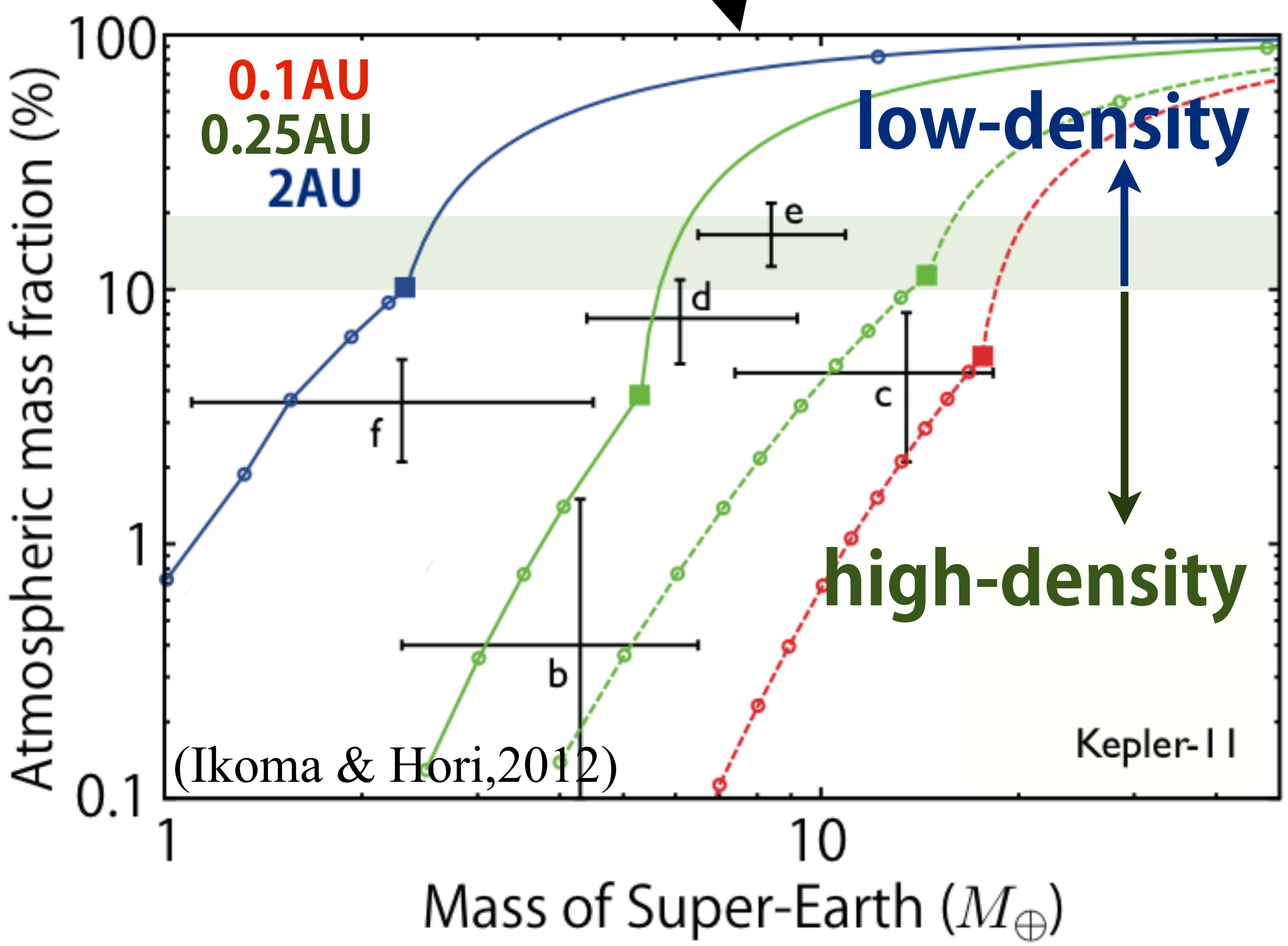


Two types of close-in Super-Earths found

(1) **high-density** (**rock/iron**) like **Mercury** & the **Earth** (e.g.) CoRoT-7b
(2) **low-density** comparable to **water** (e.g.) Kepler-11e,f , GJ1214b



Accumulation of H-He gas in a dissipating disk after G.I.

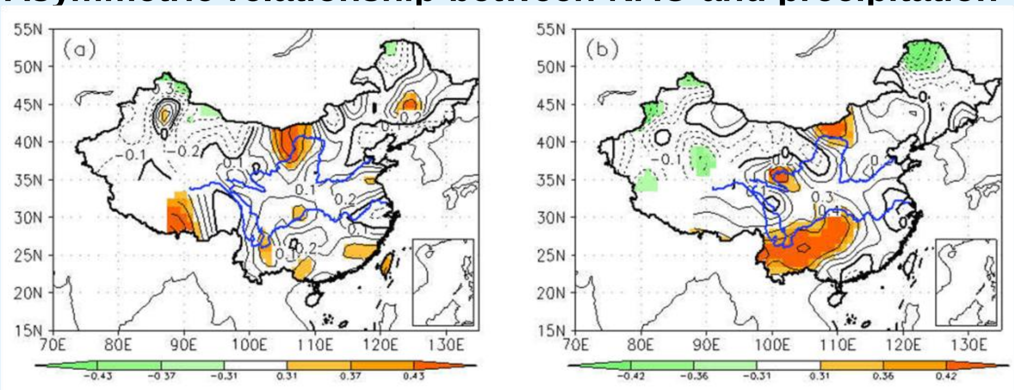


The Asymmetric Relationship between the Winter North Atlantic Oscillation and Precipitation in Southwest China

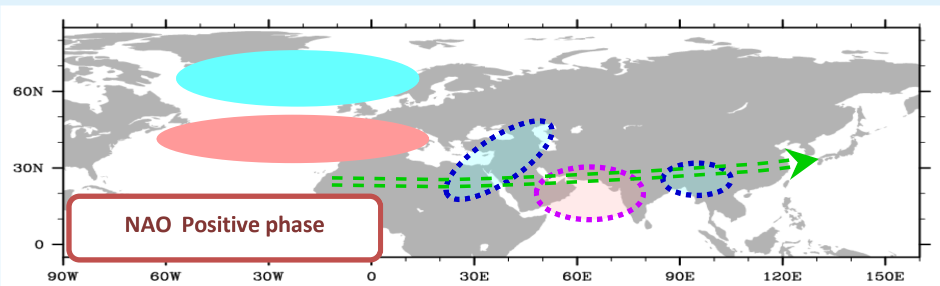
Hanlie Xu, Jianping Li, Juan Feng，Jiangyu Mao

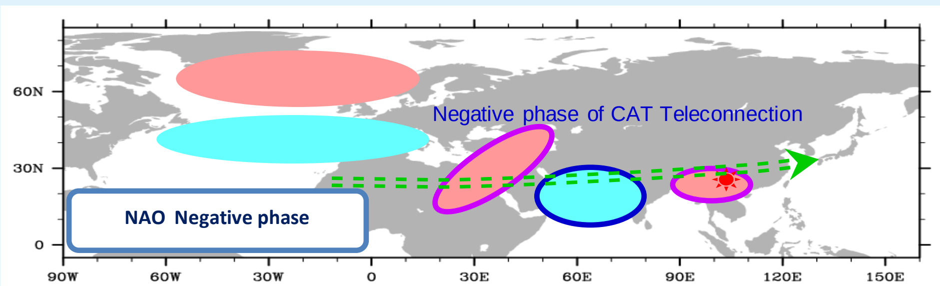
Institute of Atmospheric Physics, Chinese Academy of Sciences

Asymmetric relationship between NAO and precipitation



Asymmetric relationship between NAO and CAT teleconnection





The main circulation which influences the rainfall in Southwest China is the CAT teleconnection along the subtropical westerly