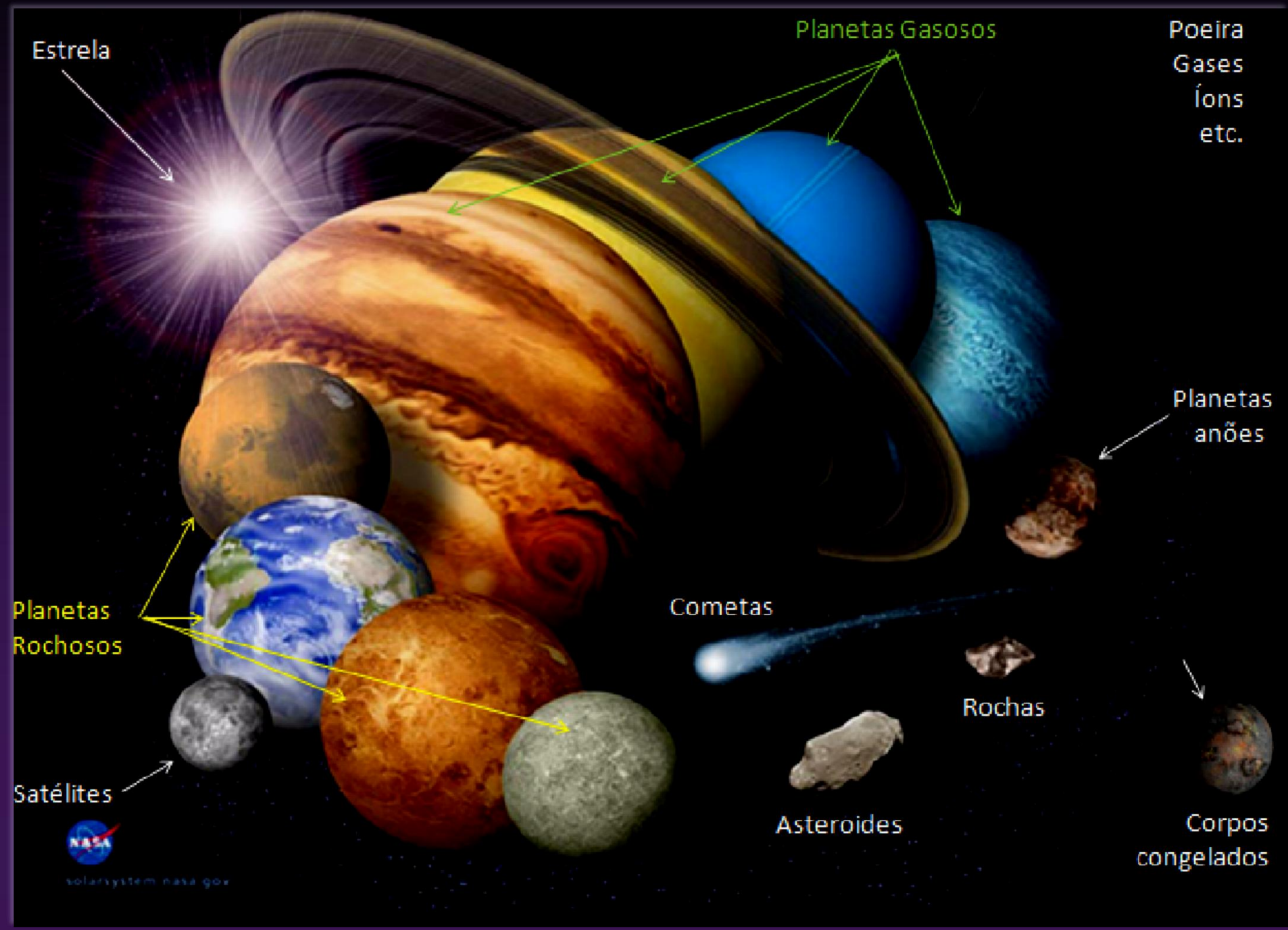
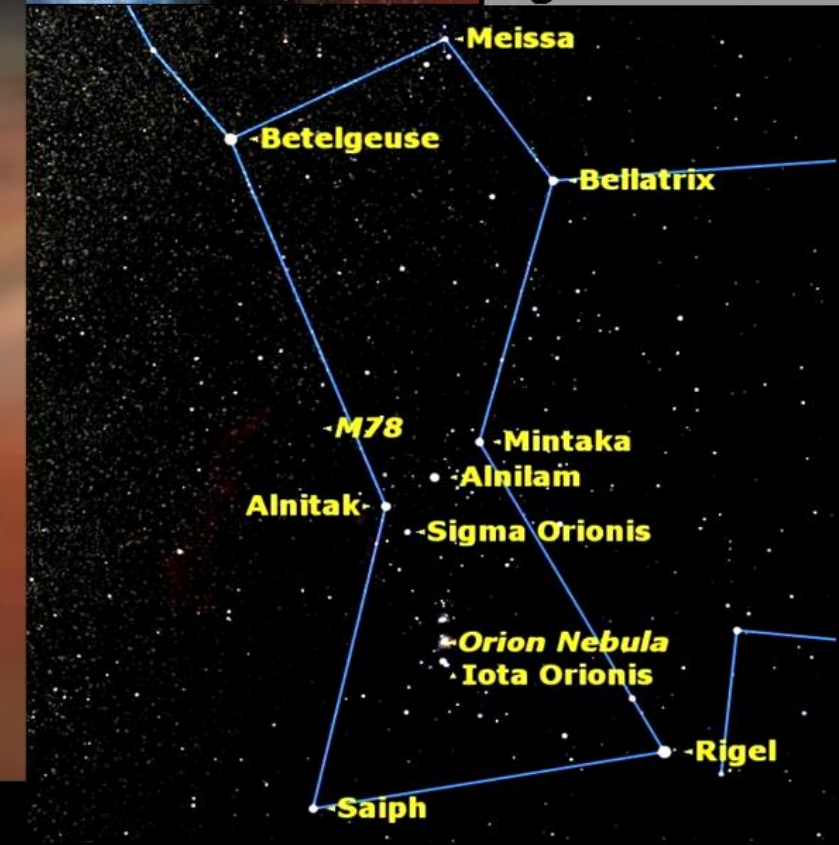
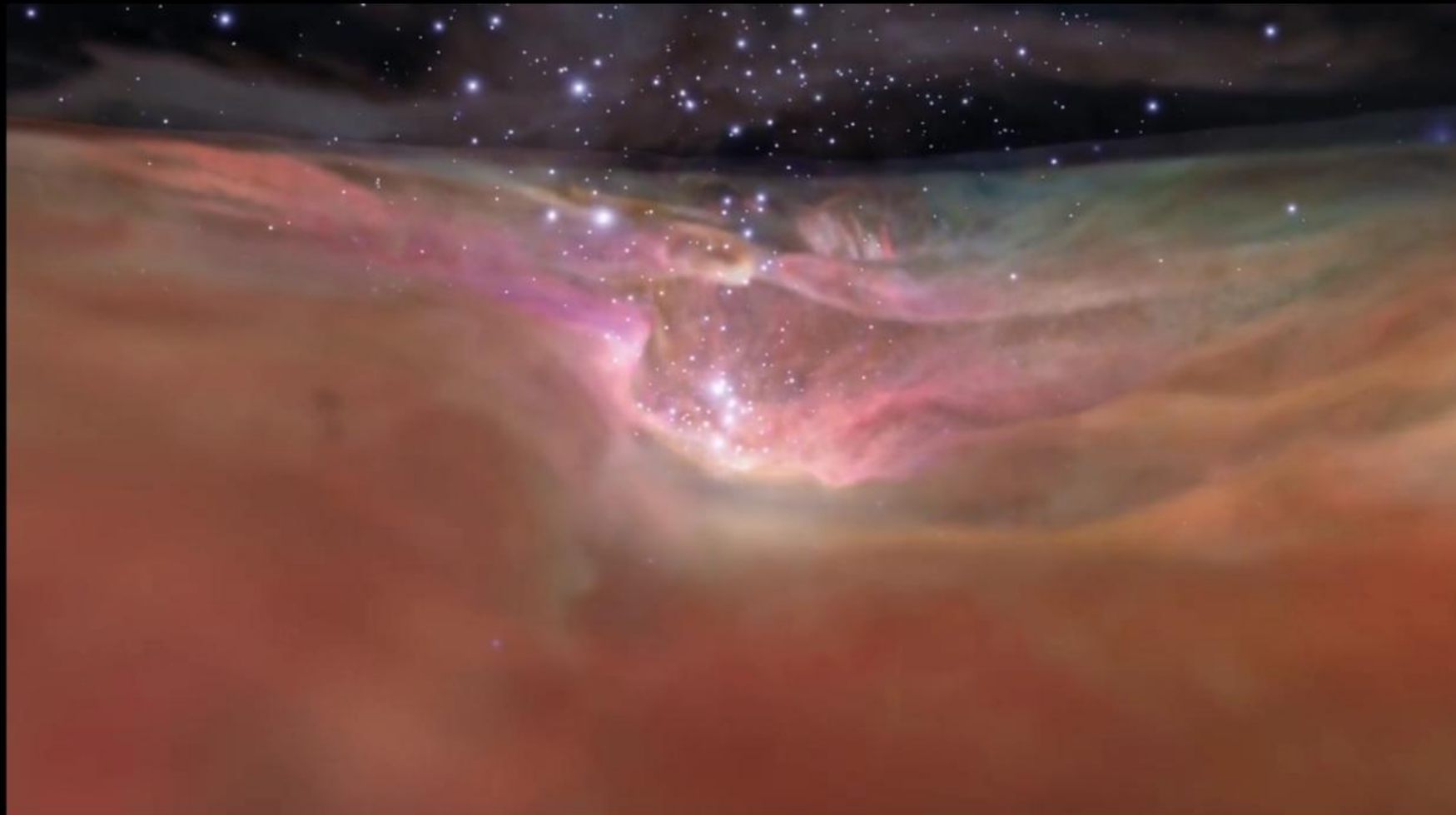


Sistema Solar. A família do Sol



Enos Picazzio
Astronomia para a Terceira Idade
IAGUSP - Maio 2024

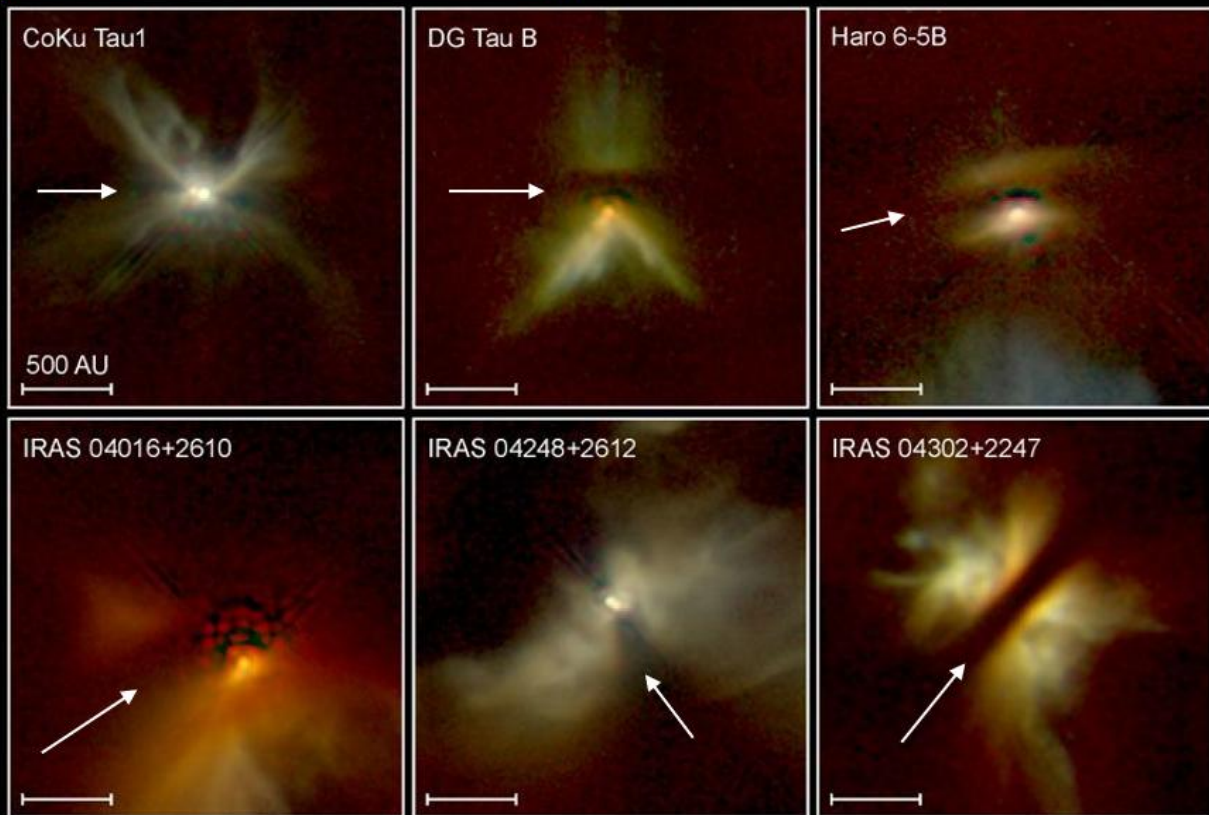
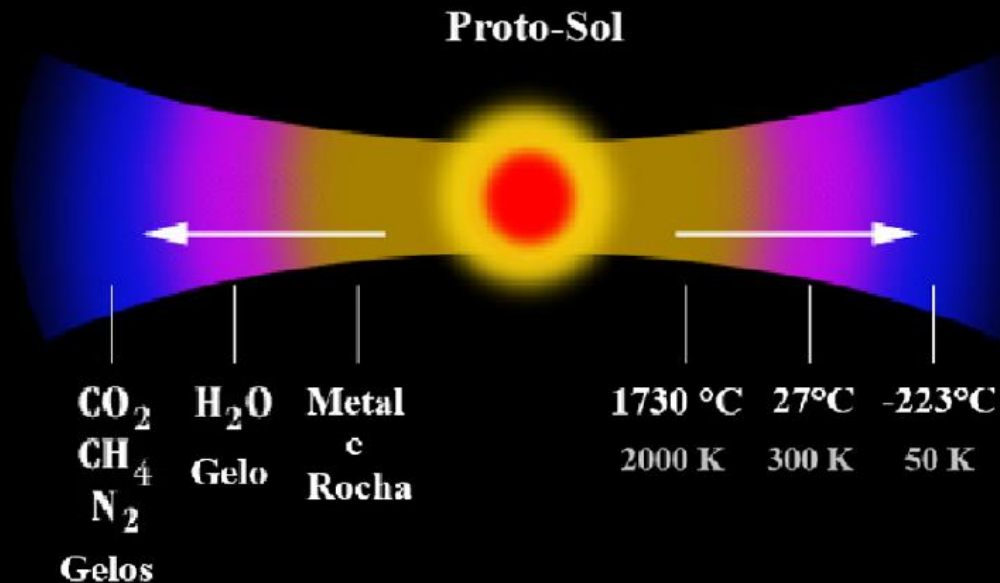
Nebulosa de Órion: um berçário de estrelas que está a cerca de 1.450 anos-luz da Terra.



Sistemas planetários em formação



- ❖ Durante a contração da nuvem forma-se um disco de matéria em torno da estrela nascente (protoestrela).
- ❖ Os objetos do sistema planetário da estrela formam-se nesse disco.



Young Stellar Disks in Infrared

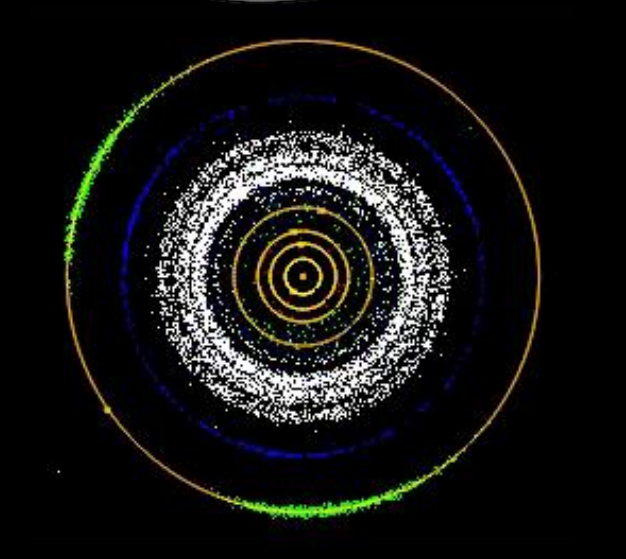
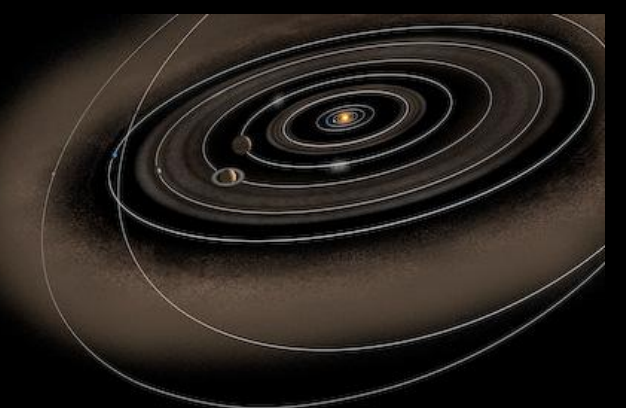
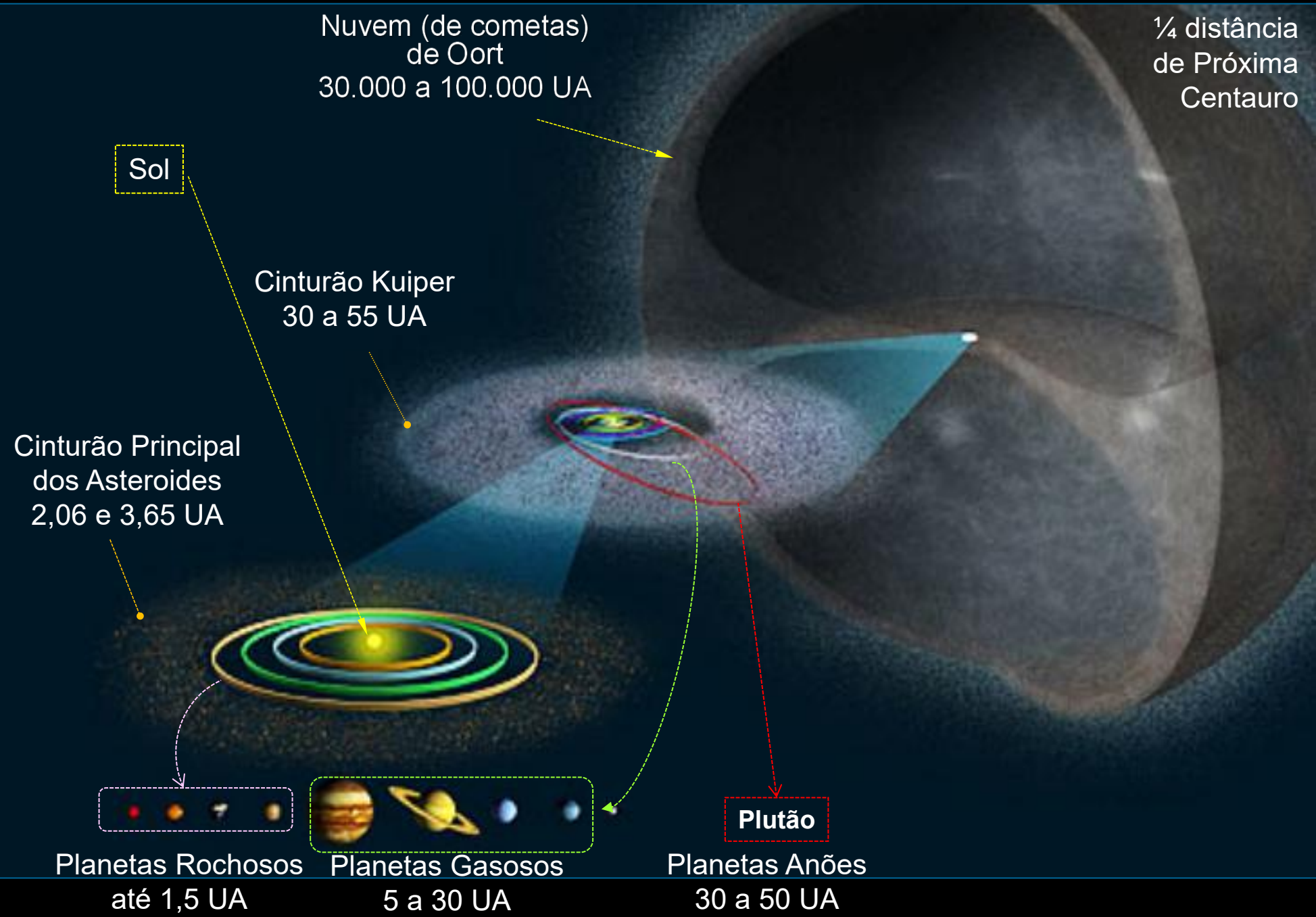
HST • NICMOS

PRC99-05a • STScI OPO

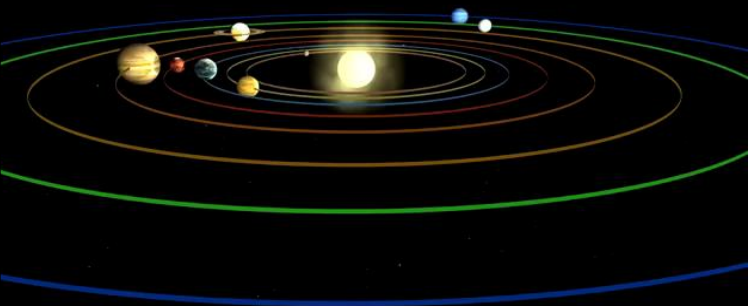
D. Padgett (IPAC/Caltech), W. Brandner (IPAC), K. Stapelfeldt (JPL) and NASA



Tamanho e forma do Sistema Solar

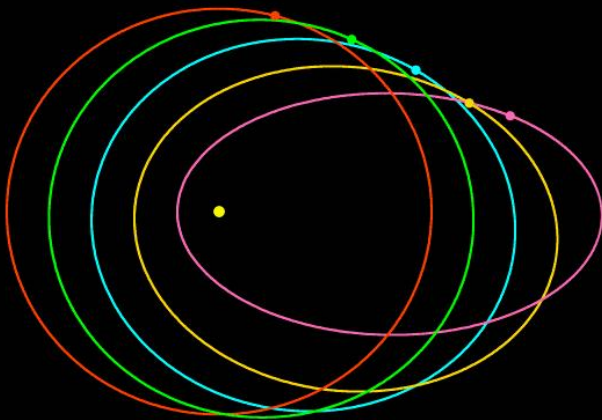


A estrutura do Sistema Solar

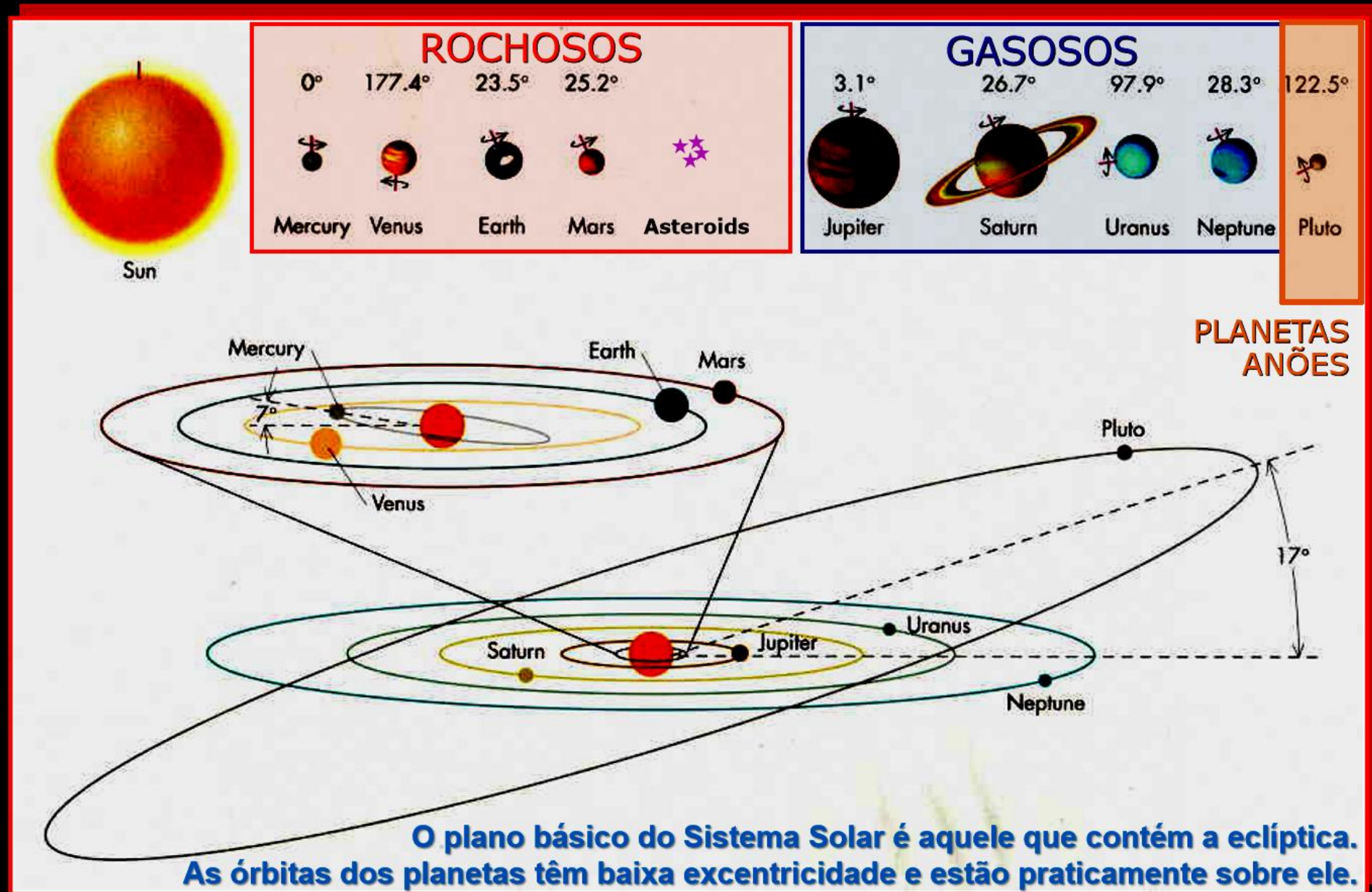


The Solar System

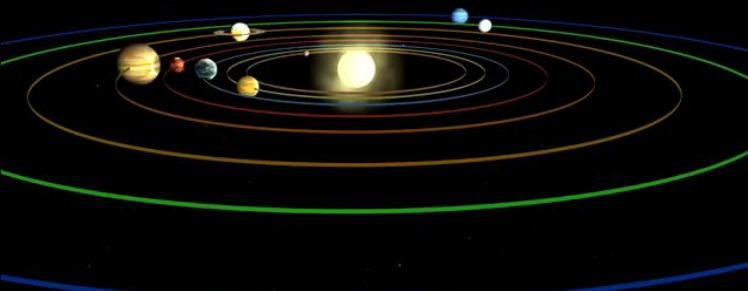
2020-04-14 00:00 Orbital eccentricity



Órbita Circular:
Excentricidade é "0"
Velocidade é constante

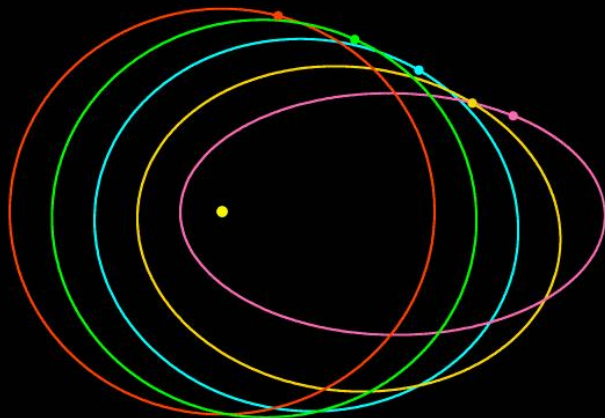


A estrutura do Sistema Solar

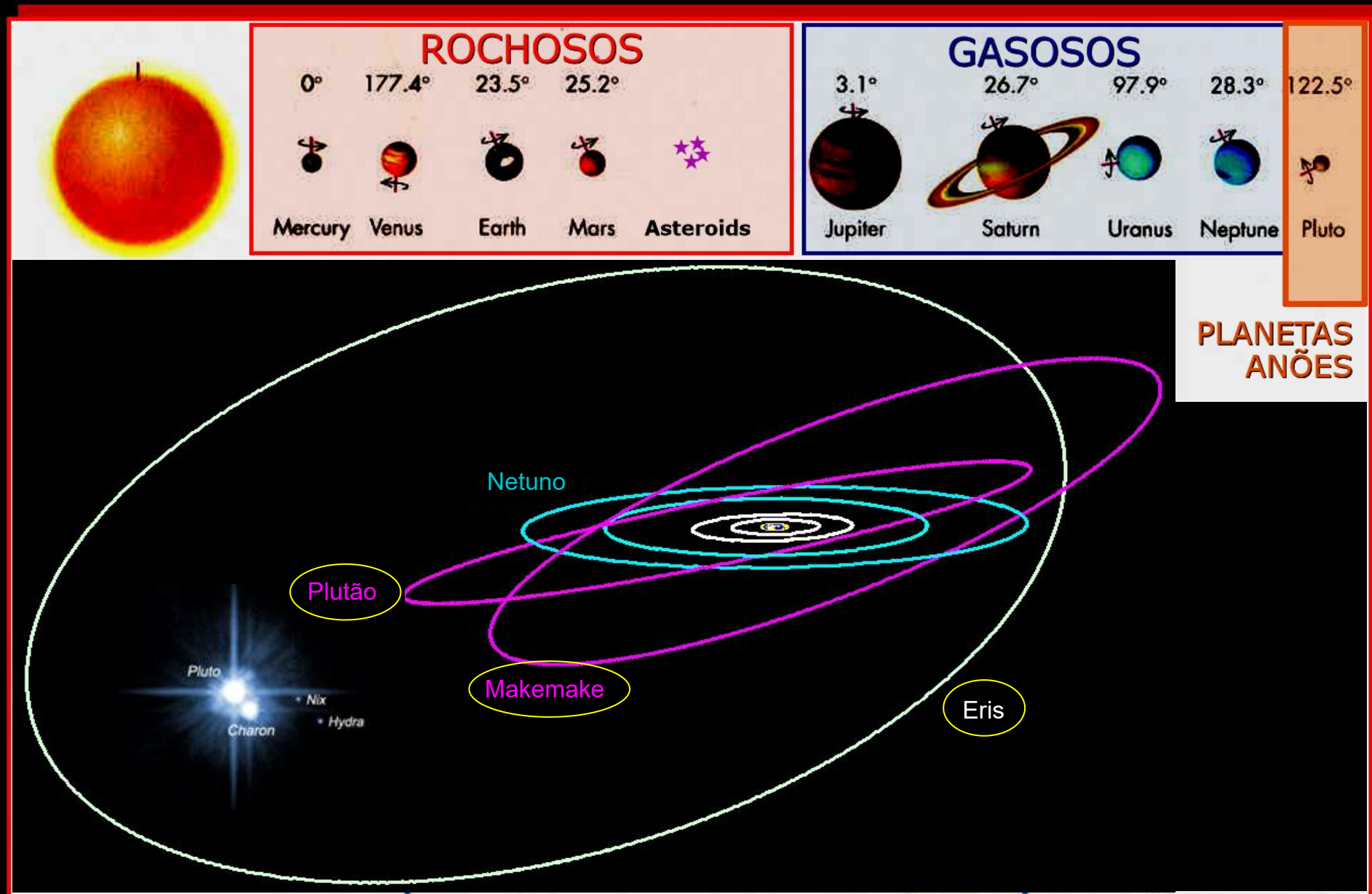


The Solar System

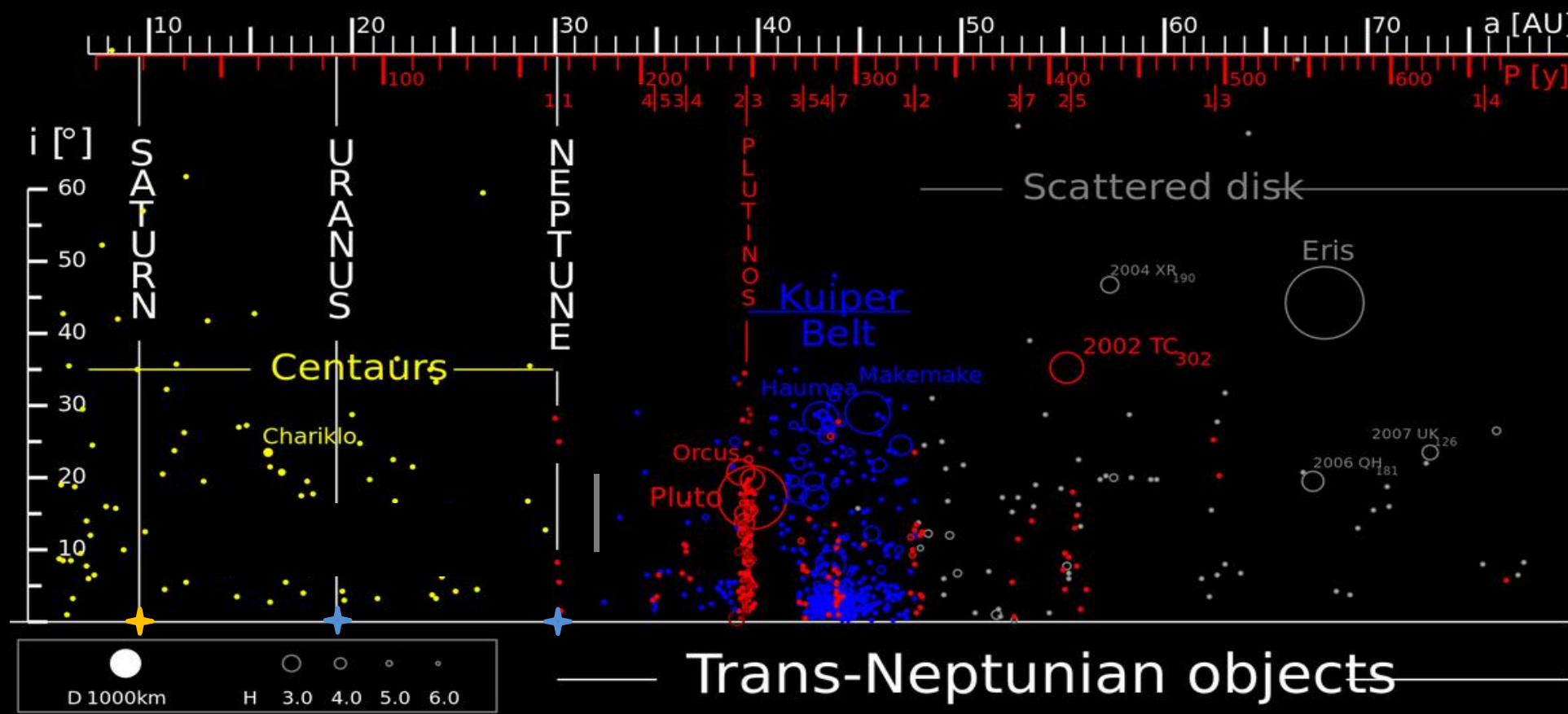
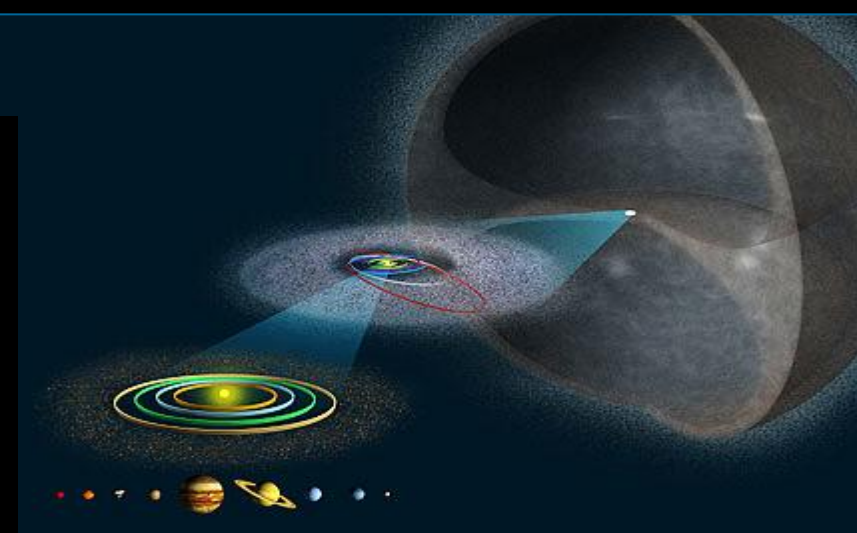
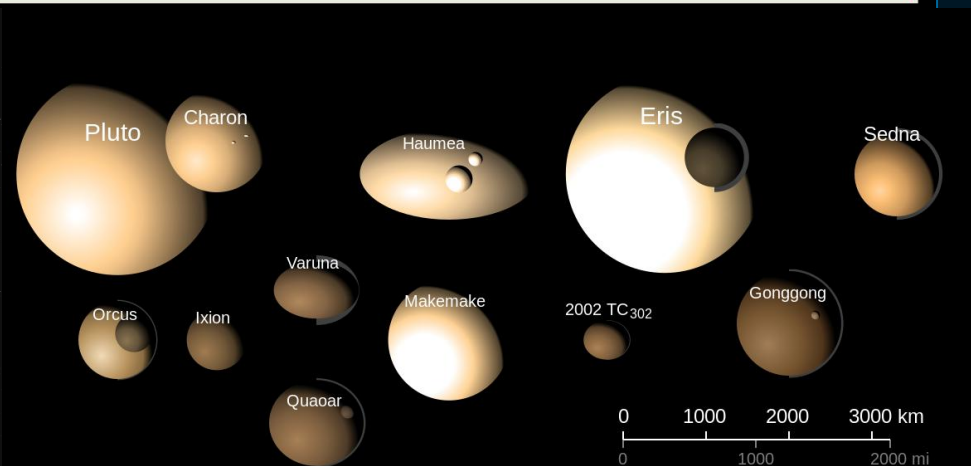
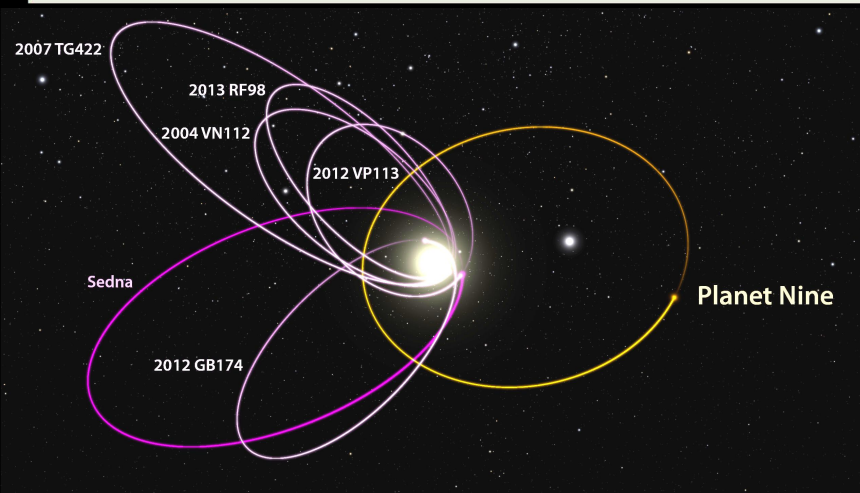
2020-04-14 00:00 Orbital eccentricity



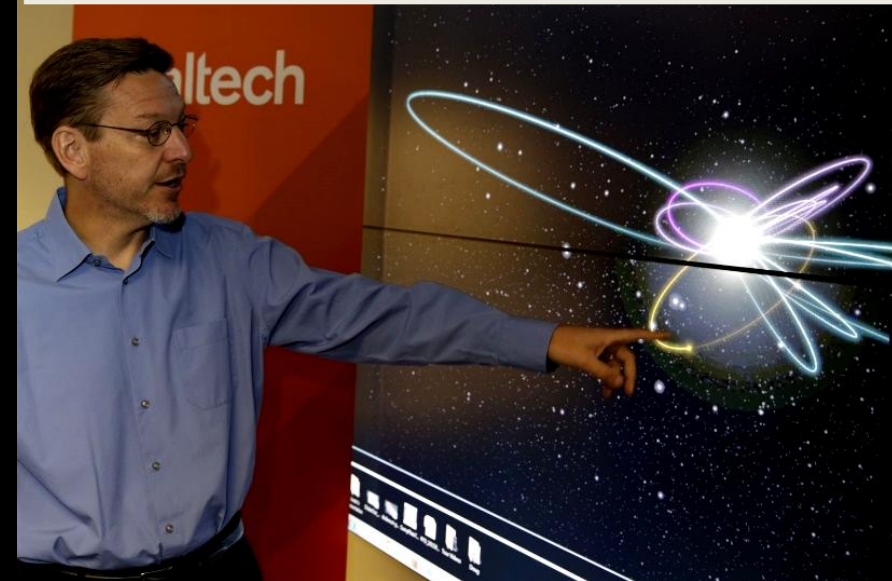
Órbita Circular:
Excentricidade é "0"
Velocidade é constante



Região Transnetuniana



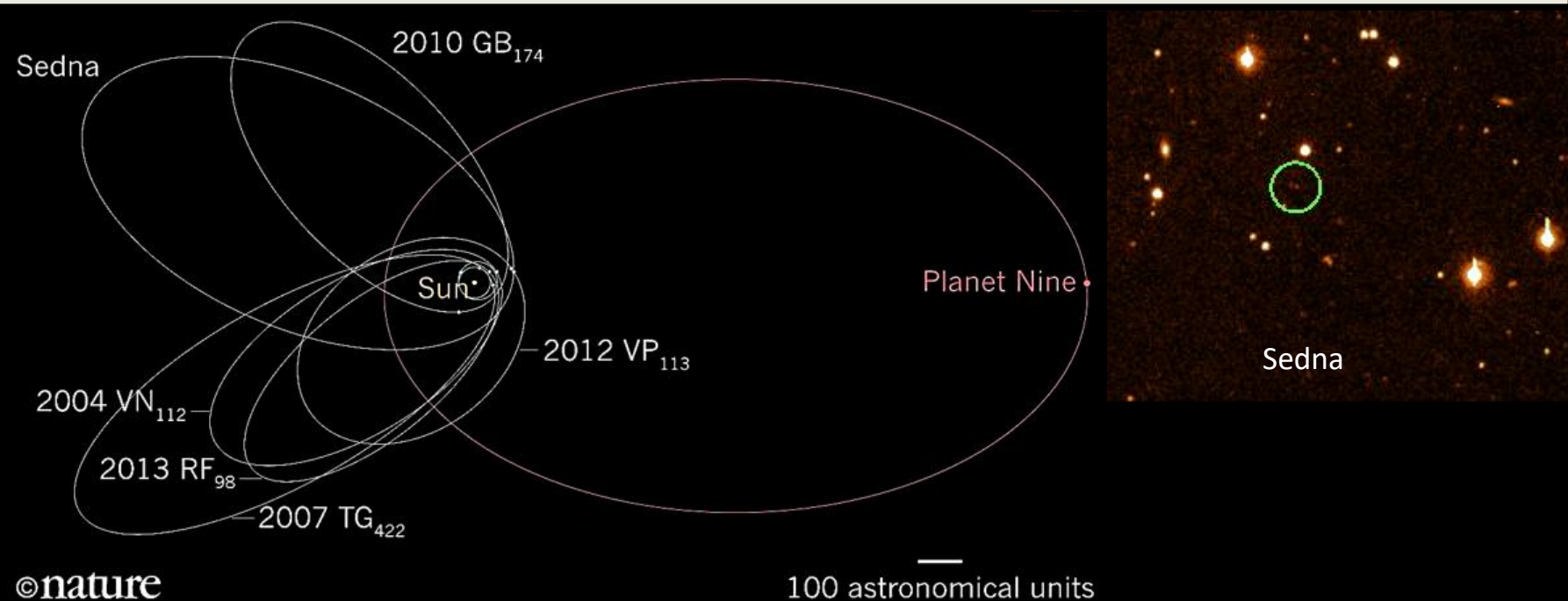
Nono planeta?



Mike Brown

A existência do nono planeta poderia explicar as formas estranhas das órbitas de vários objetos (órbitas em branco) do Cinturão de Kuiper

- Massa: ~ 6,3 vezes a da Terra
- Período: ~ 9.900 anos
- Periélio: ~ 340 u.a.
- Afélio: ~ 560 u.a.



Um planeta semelhante à Terra, com:

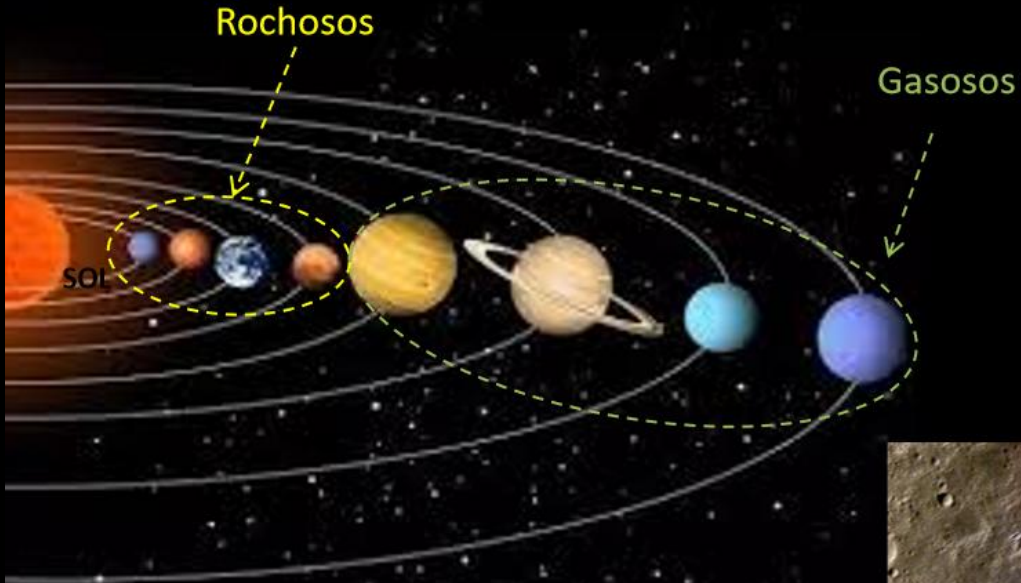
- Massa - de 1,5 e 3 M_T
- Distância - de 250 e 500 u.a
- Periélio ~ 200 ua
- Inclinação - 30°

pode explicar algumas propriedades do Cinturão de Kuiper:

Patryk Sofia Lykawka & Takashi Ito

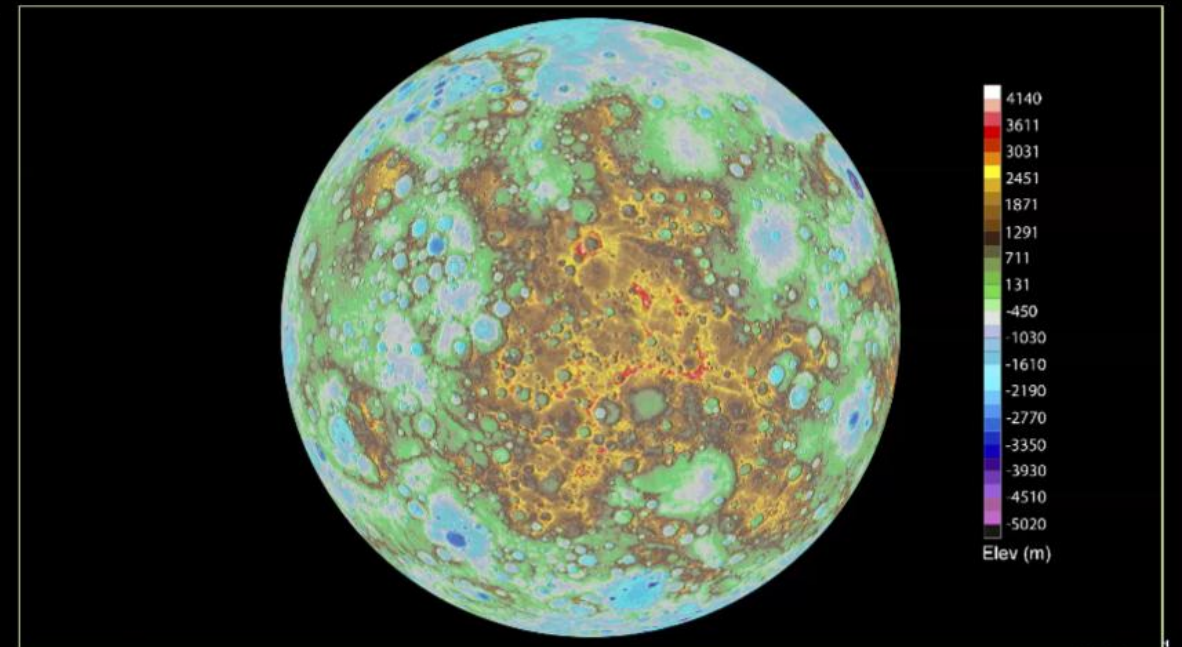
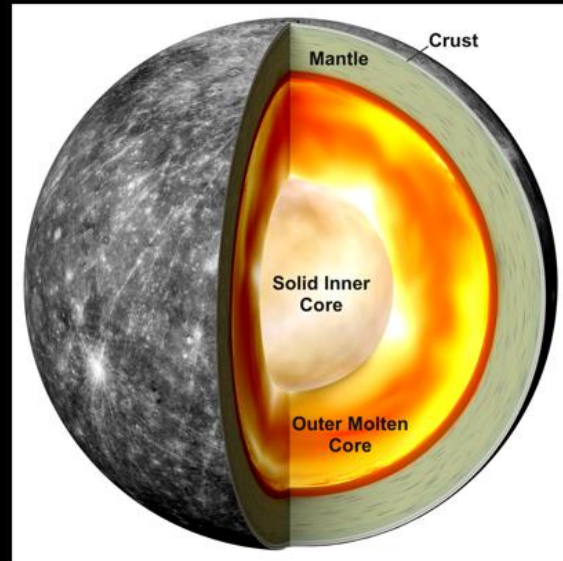


Mercúrio: o planeta mais próximo do Sol



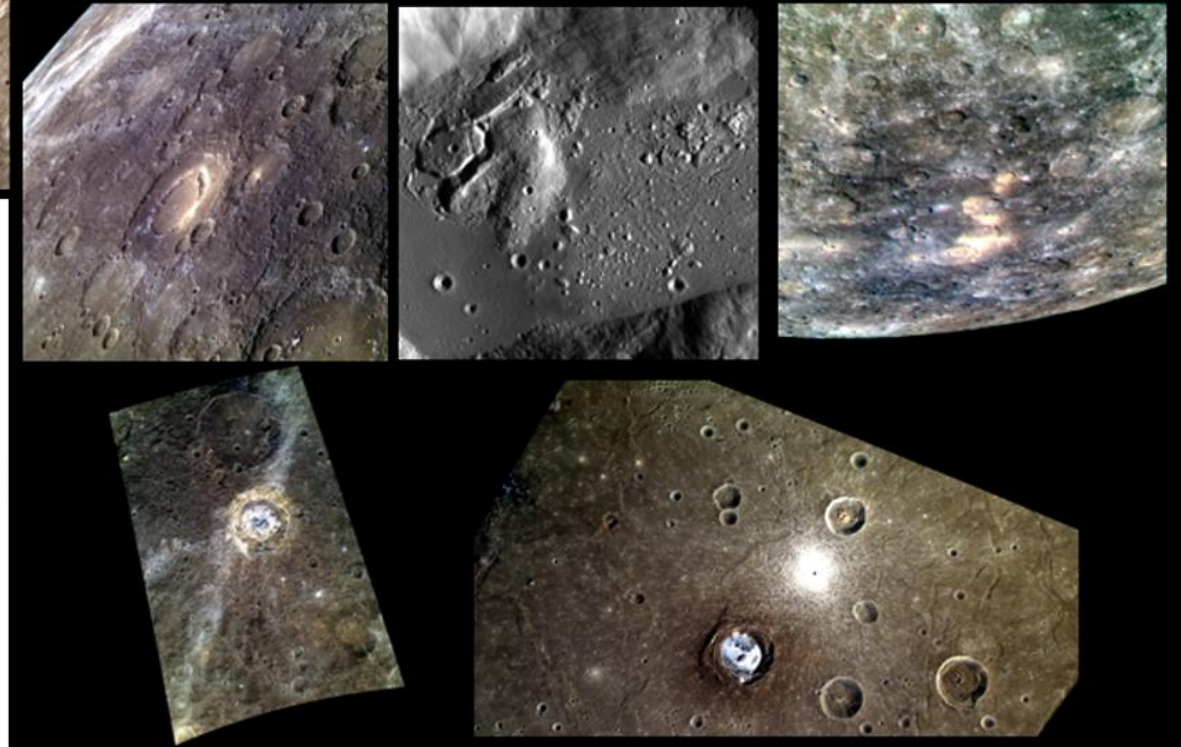
Tamanhos relativos

Temperatura: de 180°C a 430°C
Dia solar (um ciclo dia-noite completo) equivale a 176 dias terrestres – pouco
Ano: 88 dias



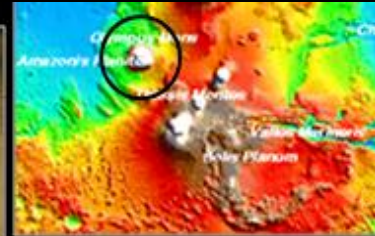
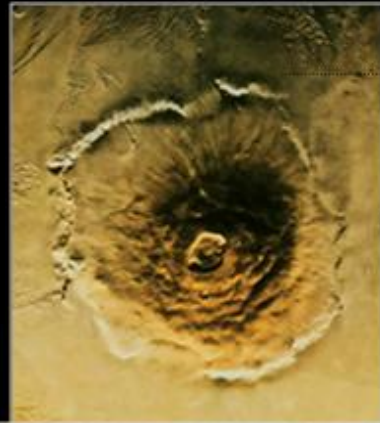
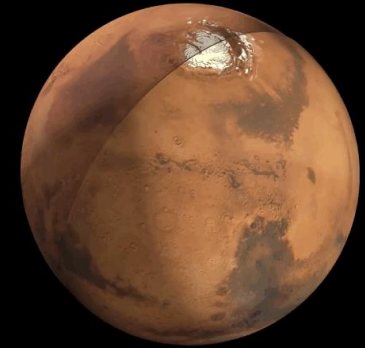
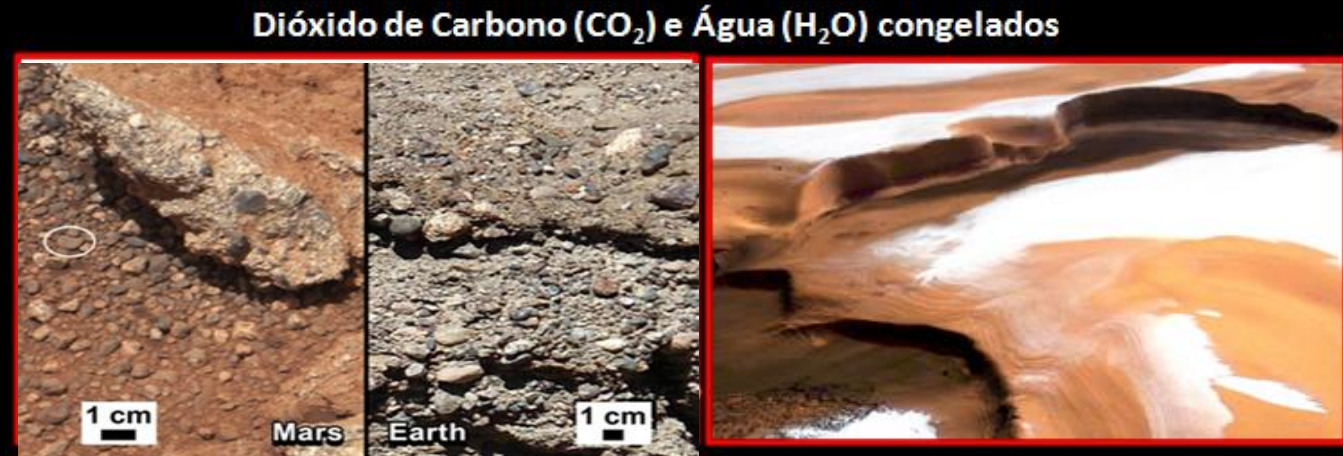
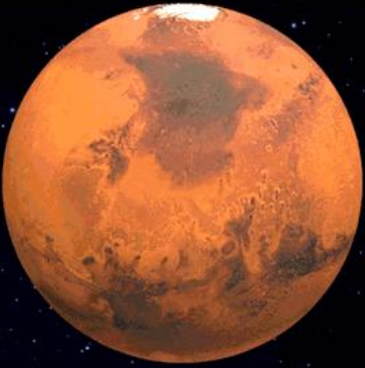
MESSENGER
Mercury Surface, Space Environment, Geochemistry, and Ranging

NASA **CARNegie** INSTITUTION FOR SCIENCE **APL** of the **JOHNS HOPKINS** UNIVERSITY APPLIED PHYSICS LABORATORY

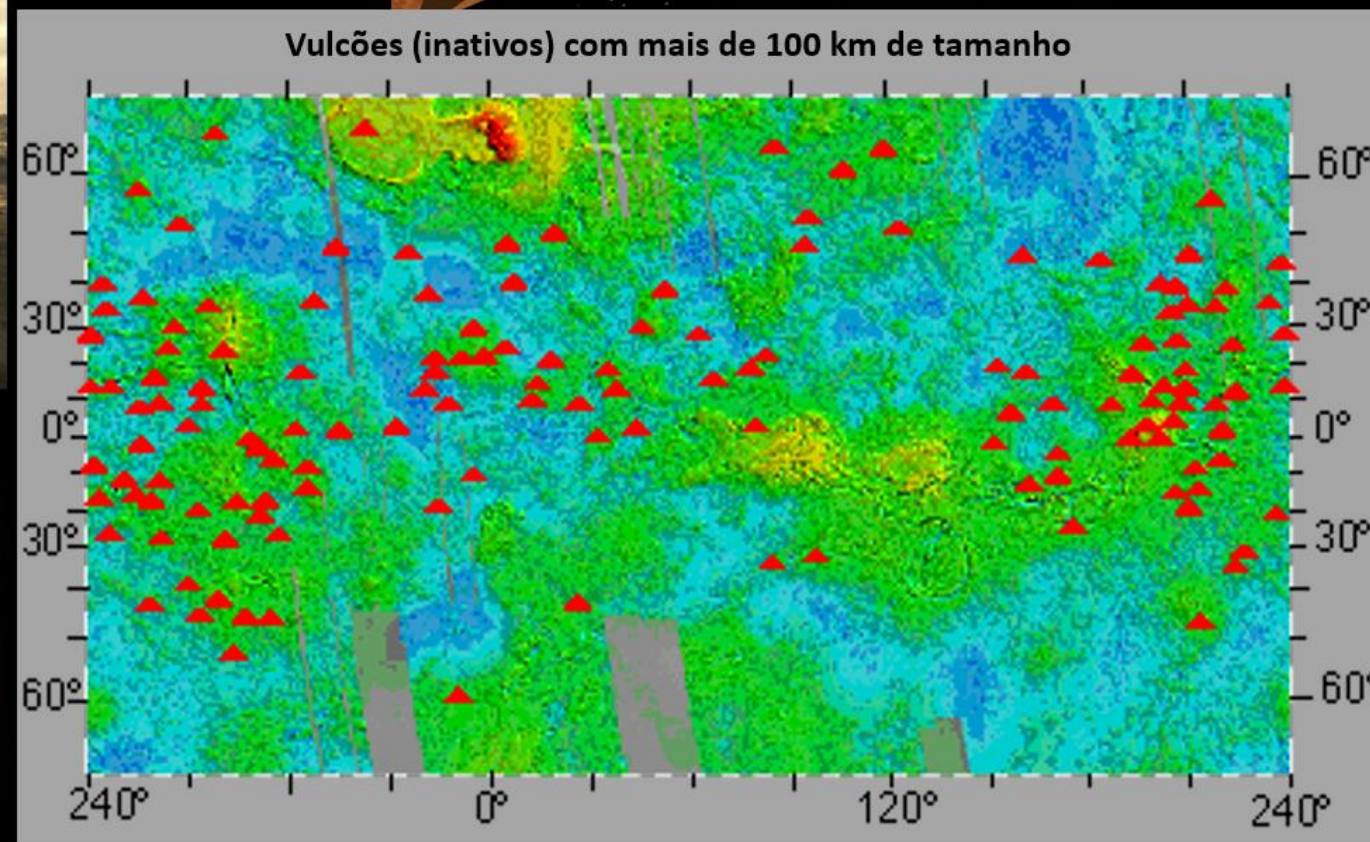
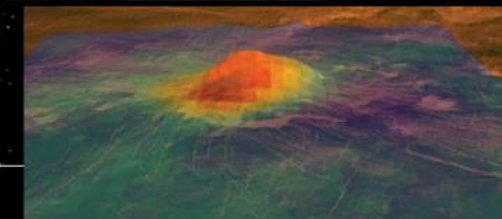
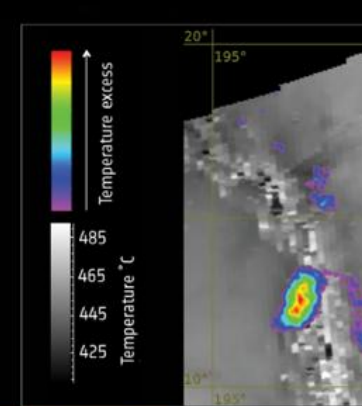
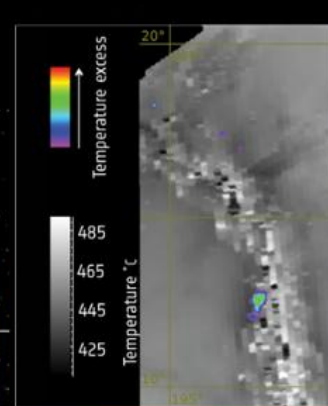
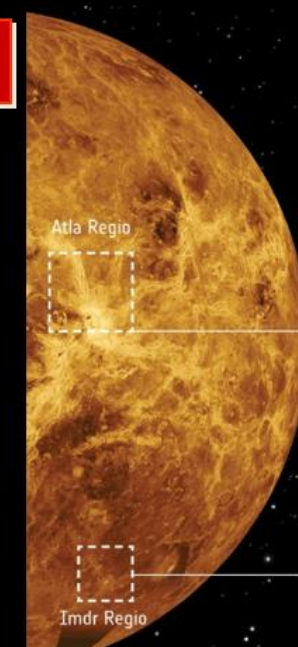
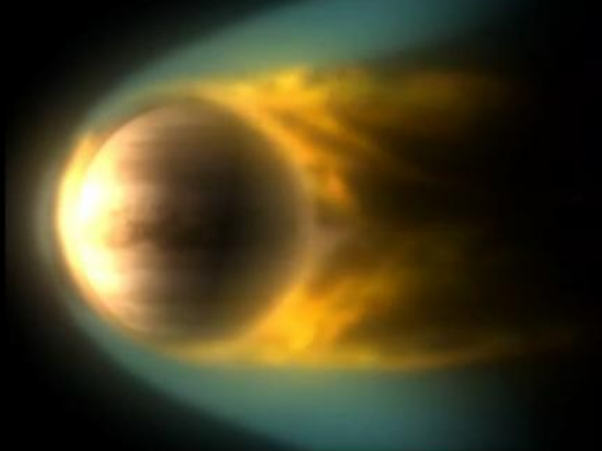
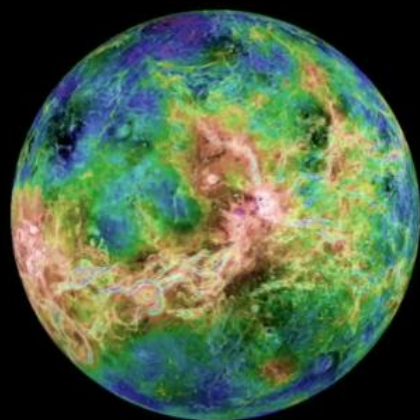


Marte. Pequeno, árido e vermelho

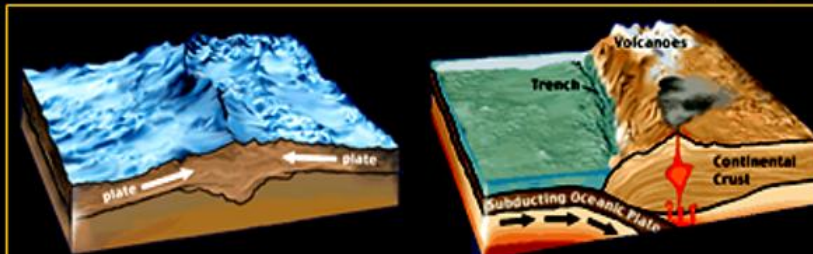
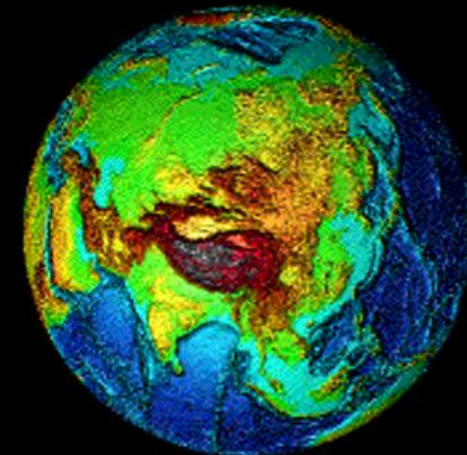
(Dia = 1d 0h 37m; Ano = 687 dias; Temperatura = de -125 °C a 22 °C)



Vênus. Um ambiente tórrido (Dia solar: 116d 18h; Ano: 225d; Temp: 475 °C)



Terra. Um planeta dinâmico



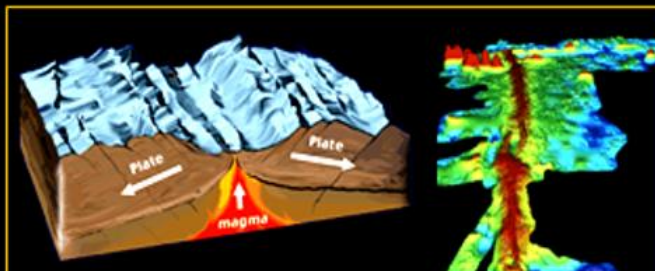
Tectonismo por colisão entre placas

Margens Destrutivas
(convergência)



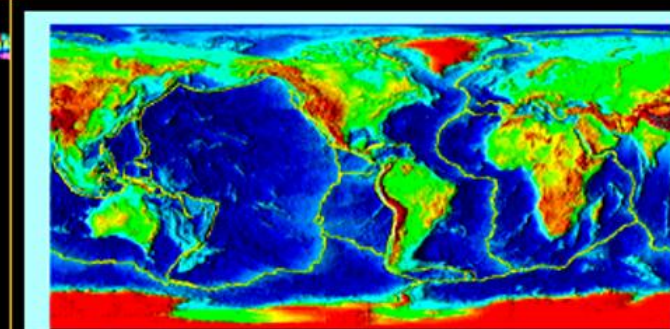
Tectonismo por deslocamento lateral entre placas

Margens Conservativas
(deslocamento relativo)



Tectonismo por separação entre placas

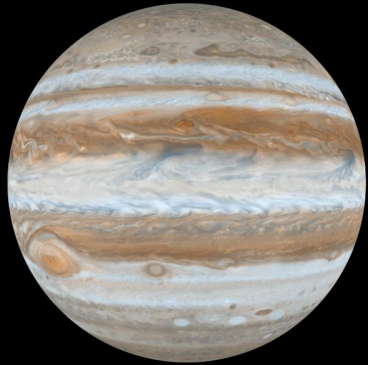
Margens Construtivas
(centros de espalhamento)



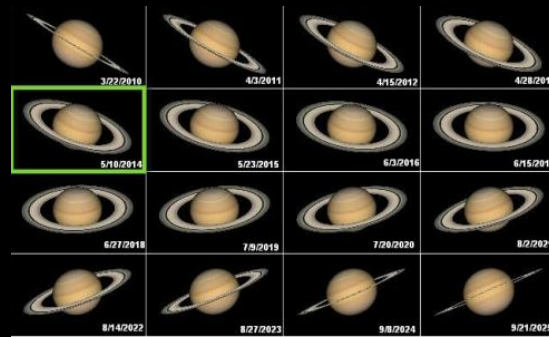
Os Planetas Gigantes Gasosos

(Júpiter: Dia= 09h56m; Ano=11,78 anos / Netuno: Dia=16h06m; Ano=165 anos)

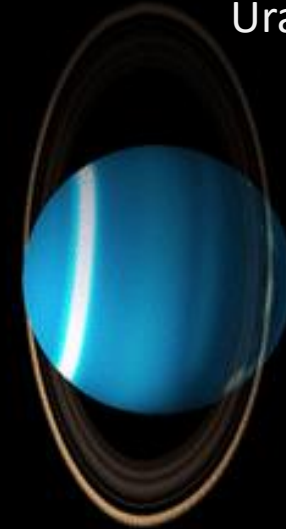
Júpiter



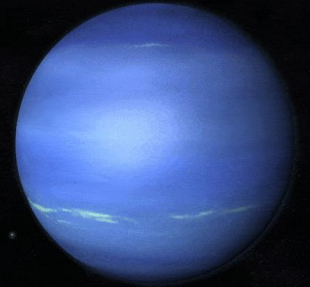
Saturno



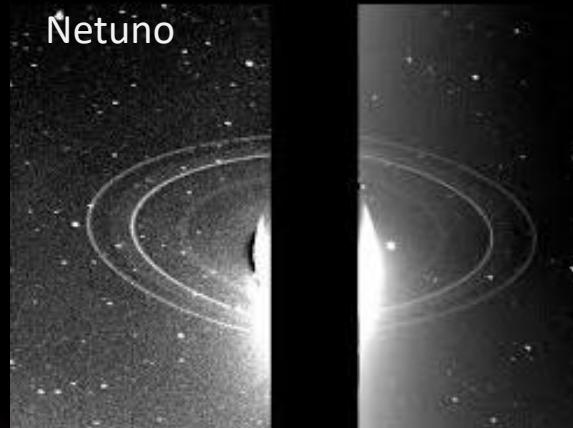
Urano



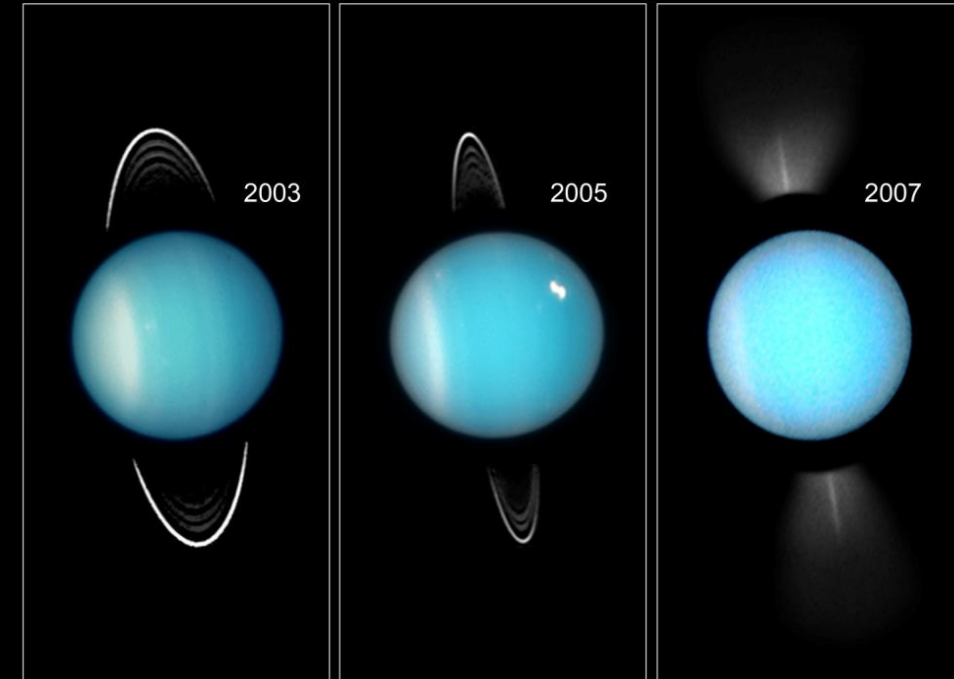
Netuno



Netuno

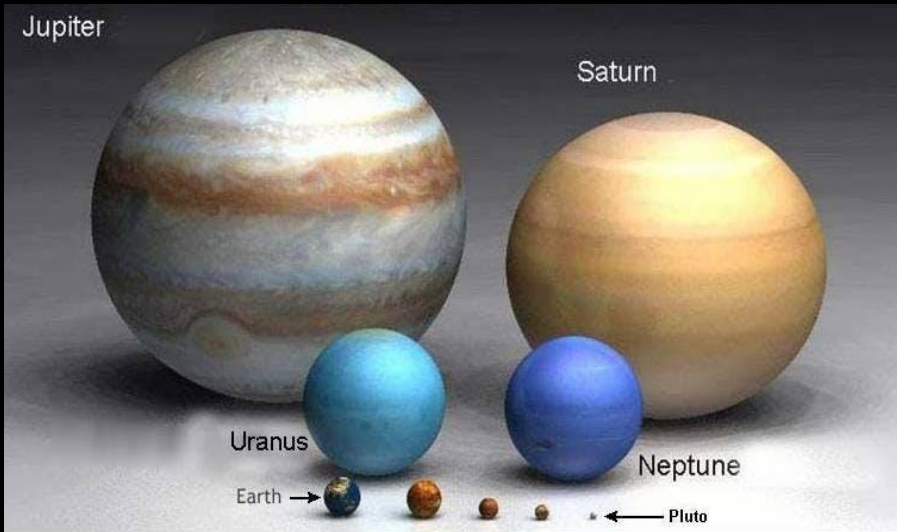


Urano ■ Hubble Space Telescope ACS/HRC WFPC2



Jupiter

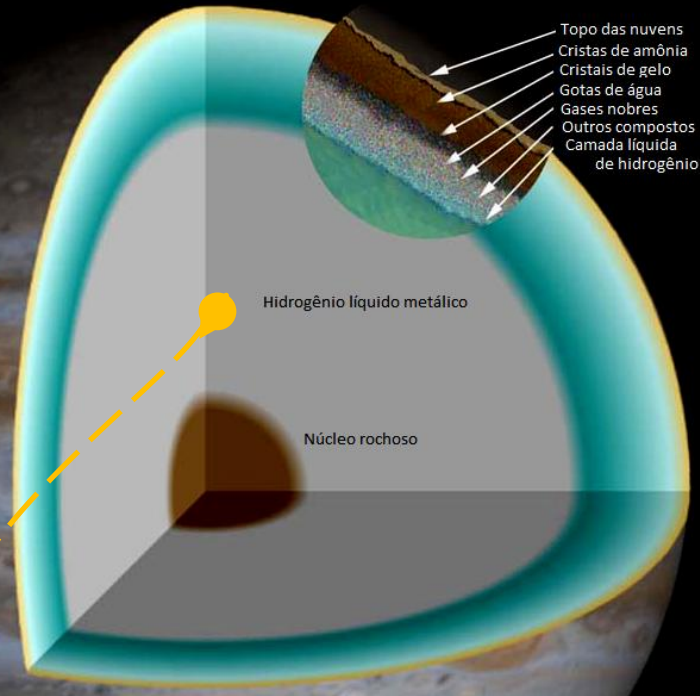
Saturn



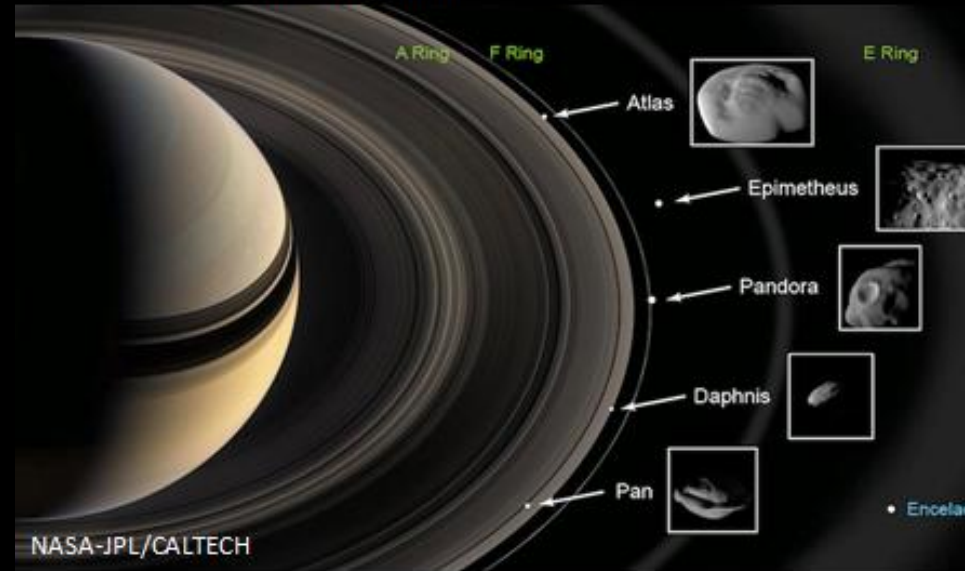
Saturno



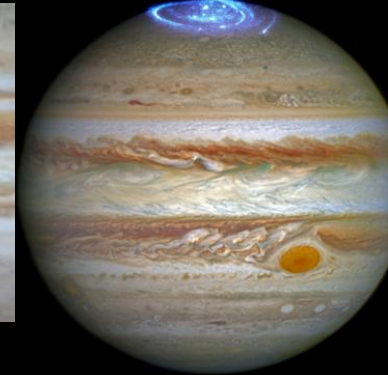
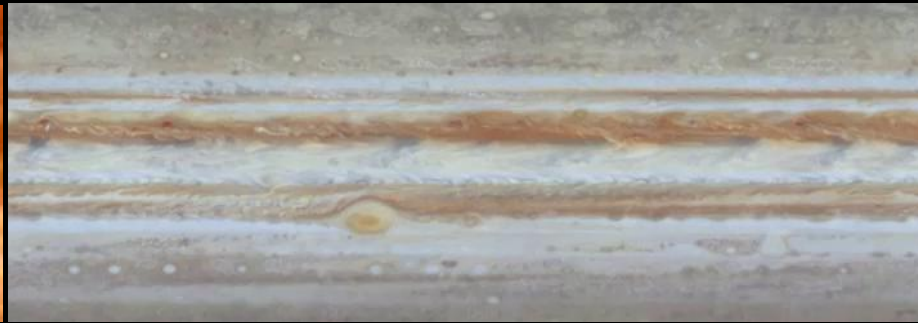
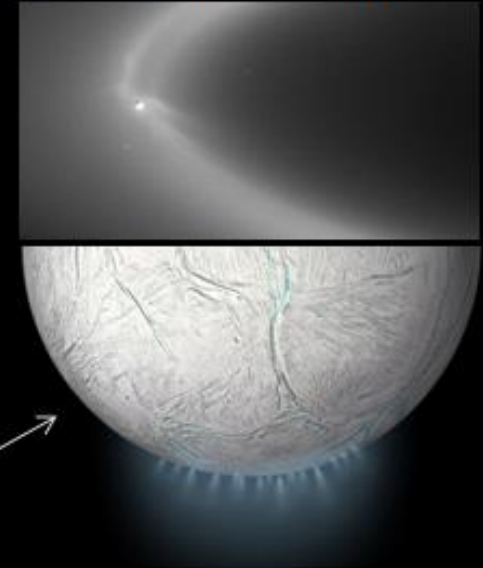
Júpiter e Saturno: os maiores planetas



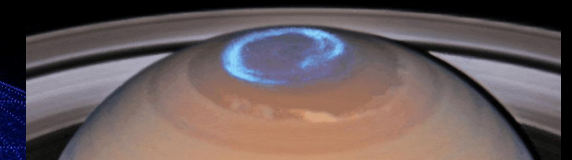
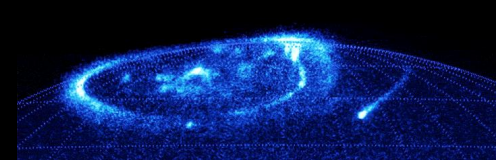
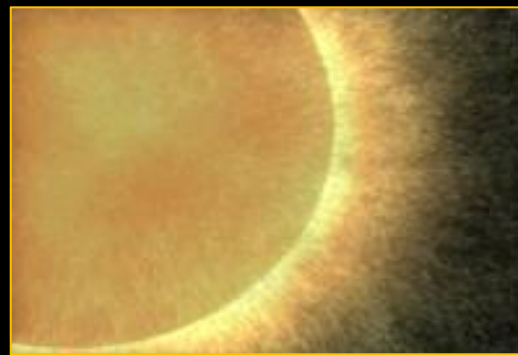
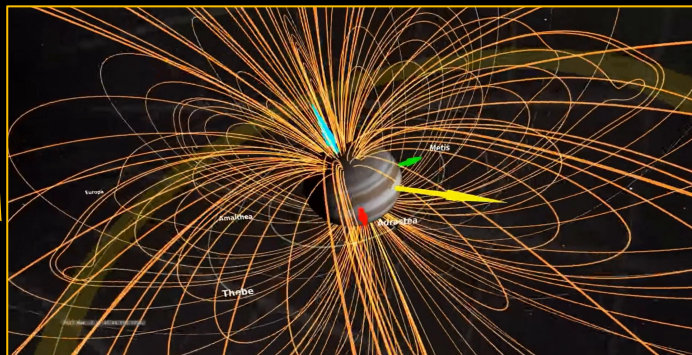
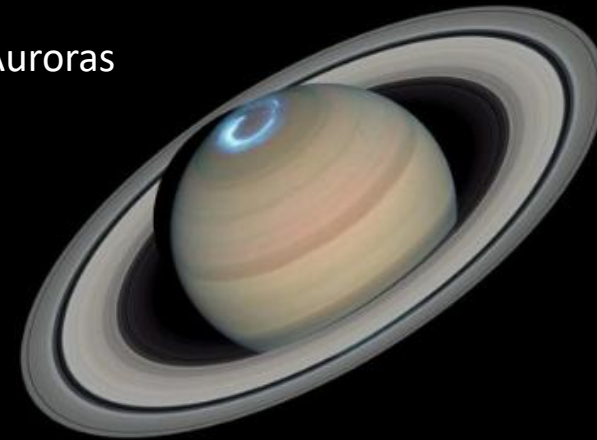
Anéis e pequenos satélites



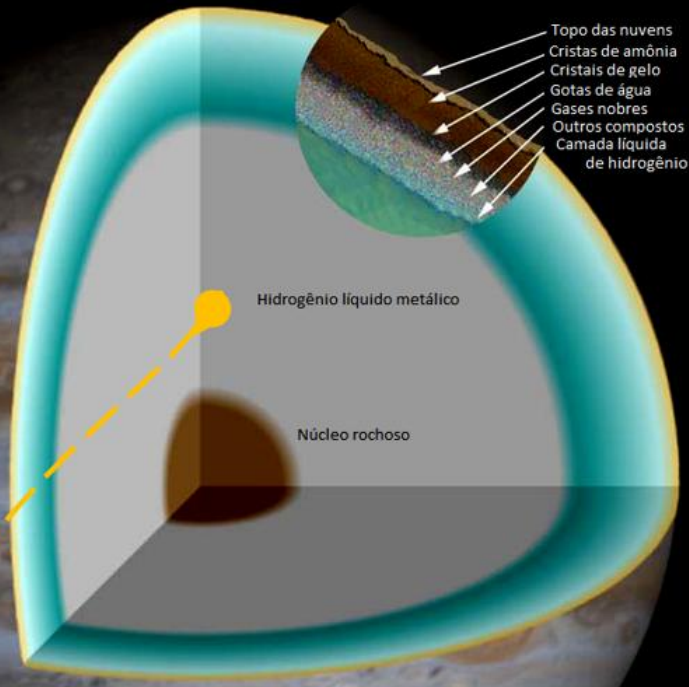
Encélado é o responsável pelo Anel E



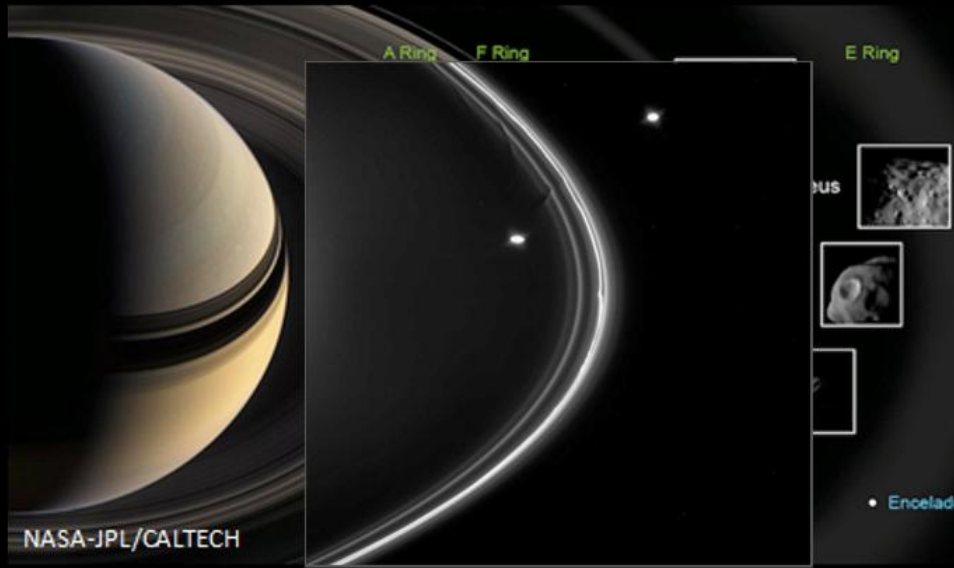
Auroras



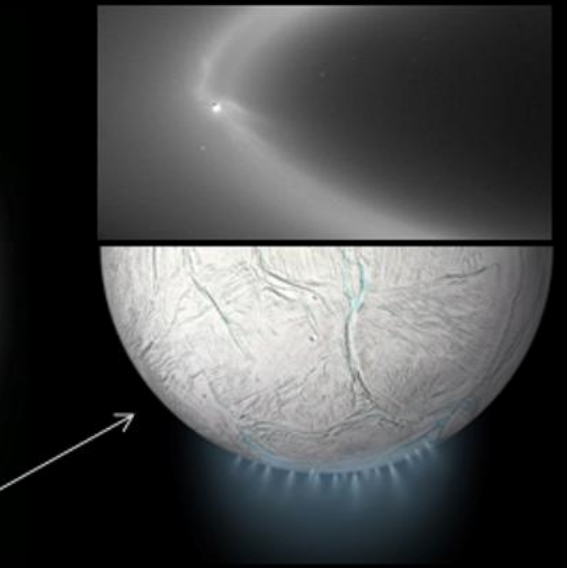
Júpiter e Saturno: os maiores planetas



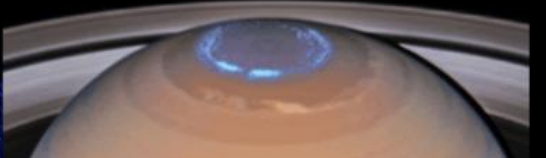
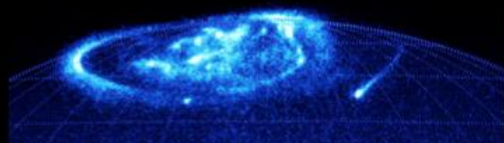
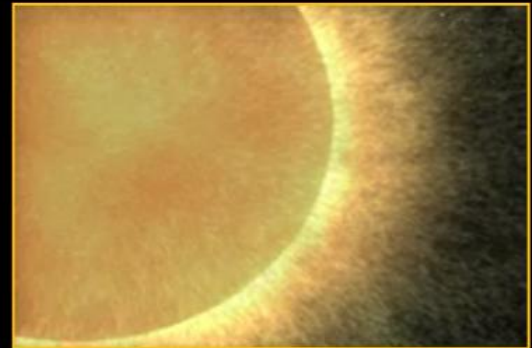
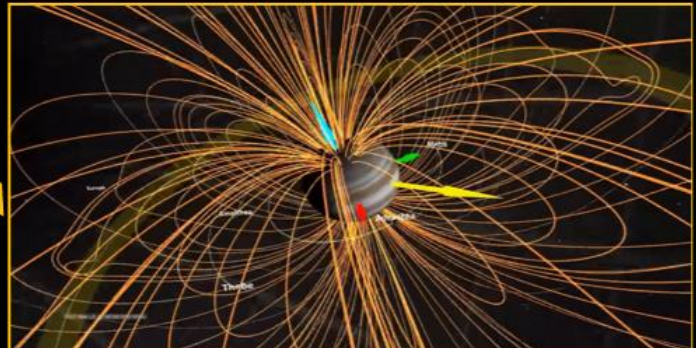
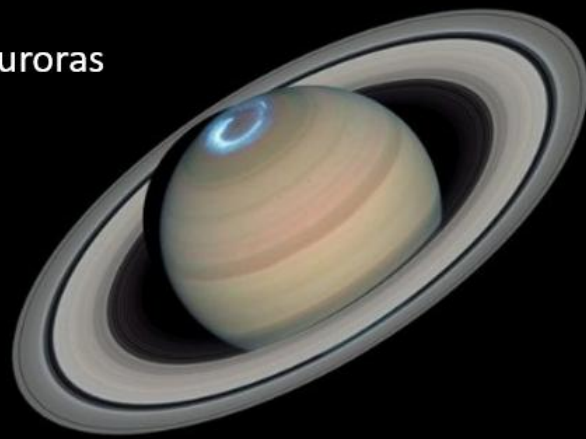
Anéis e pequenos satélites



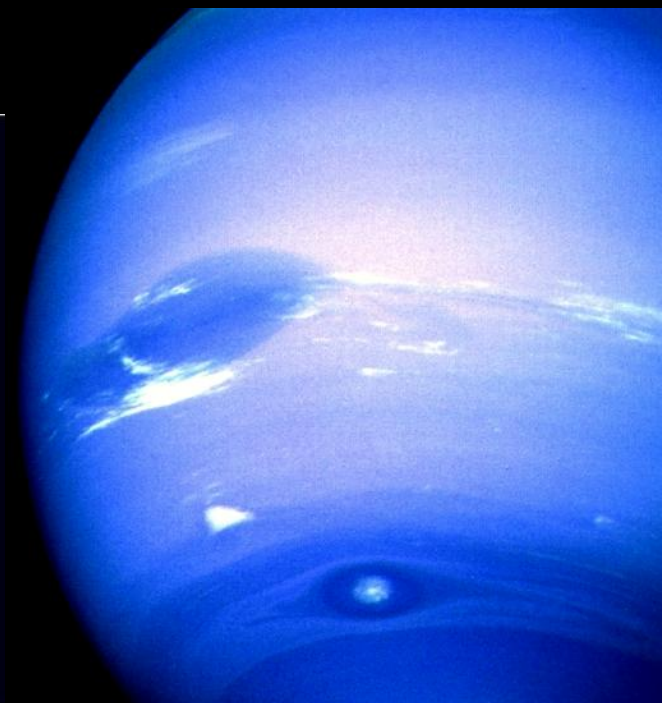
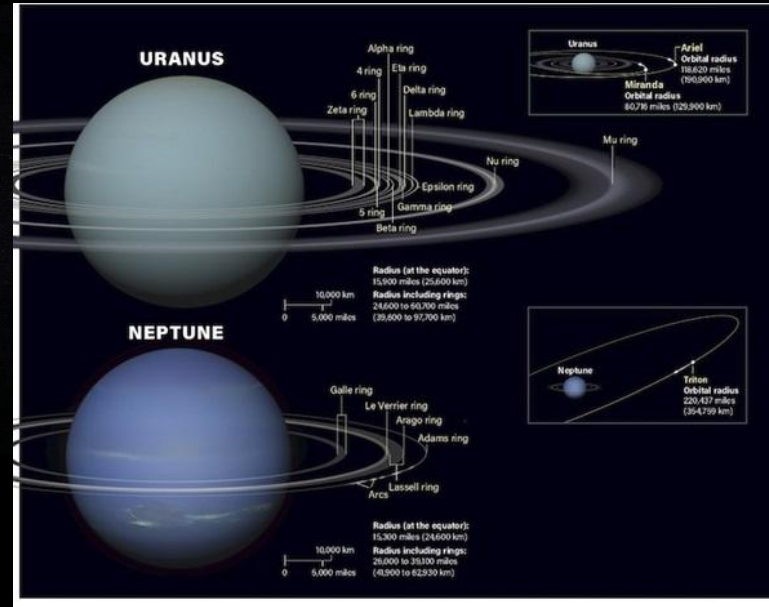
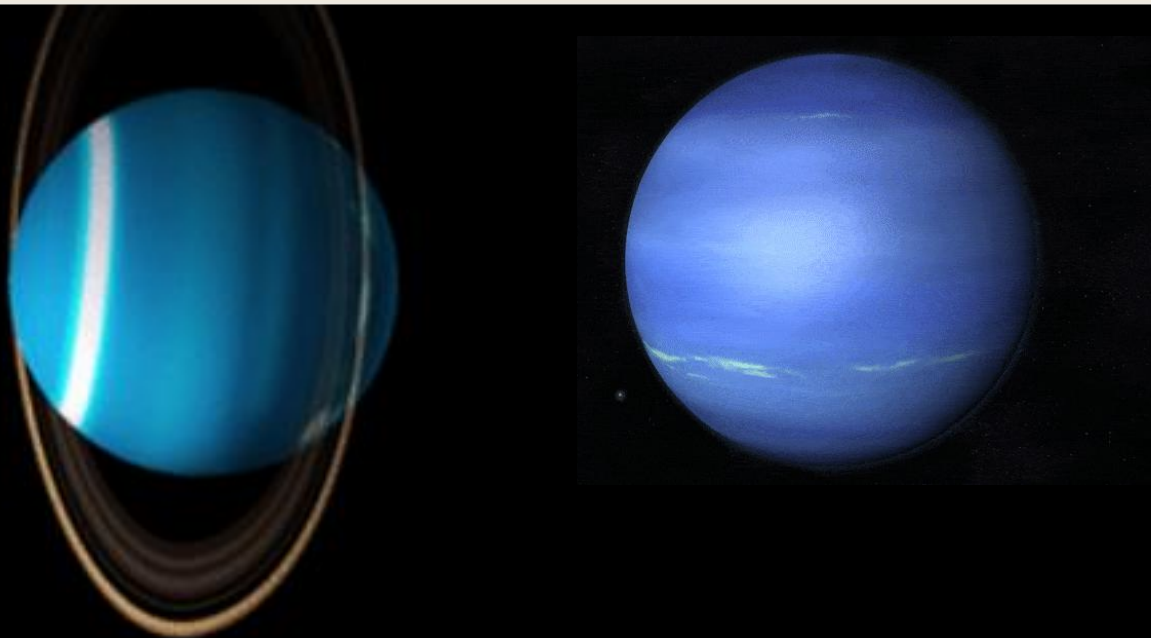
Encélado é o responsável pelo Anel E



Auroras

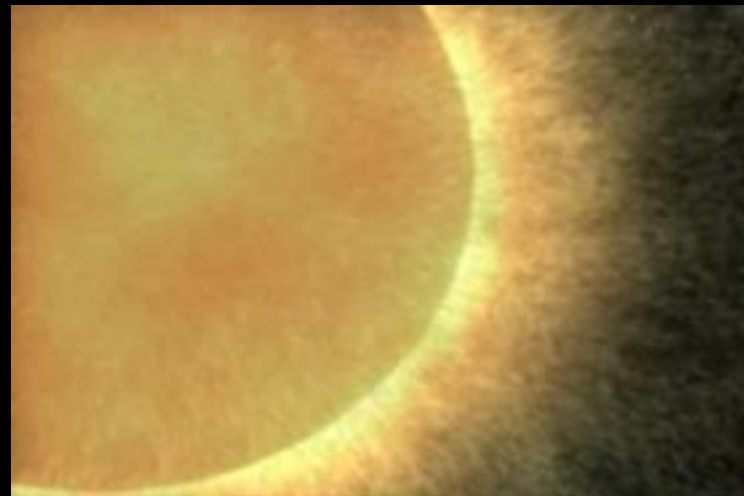
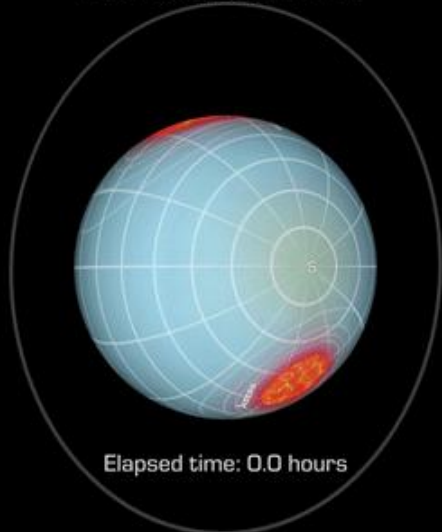


Urano e Netuno. Os gasosos congelados



Urano e Netuno são conhecidos como **gigantes de gelo**, porque são mais ricos em gases mais densos que Júpiter e Saturno. Mas apresentam diferenças significativas. (NASA / JPL / PlanetS)

Uranus: Oct. 2021



NASA/ESO imagery



Satélites



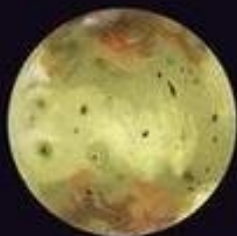
Ganymede
Jupiter



Titan
Saturn



Callisto
Jupiter



Io
Jupiter



Moon
Earth



Europa
Jupiter



Triton
Neptune



Titania
Uranus



Rhea
Saturn



Oberon
Uranus



Iapetus
Saturn



Charon
Pluto



Umbriel
Uranus



Ariel
Uranus



Dione
Saturn



Tethys
Saturn



Enceladus
Saturn



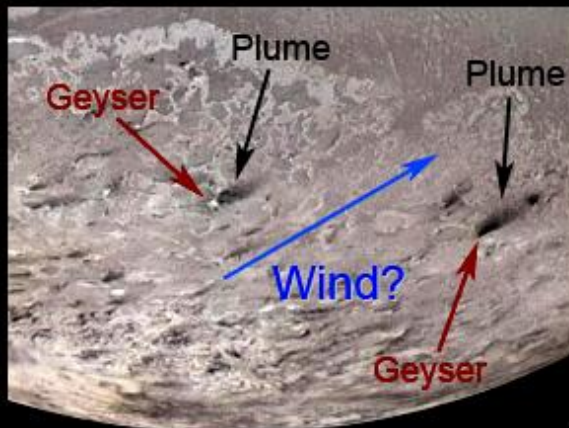
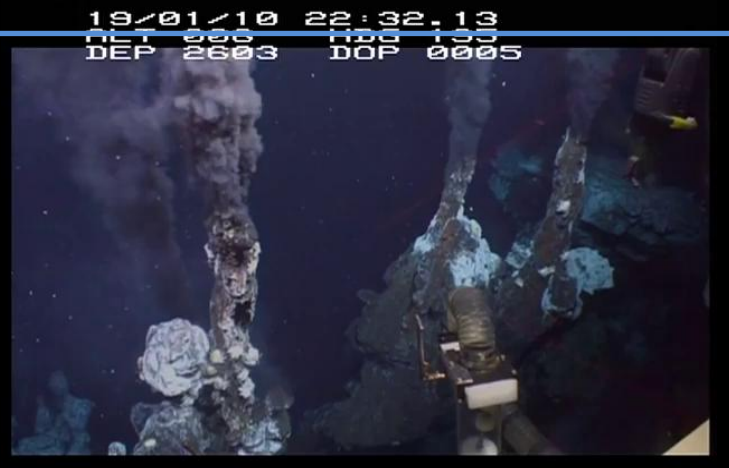
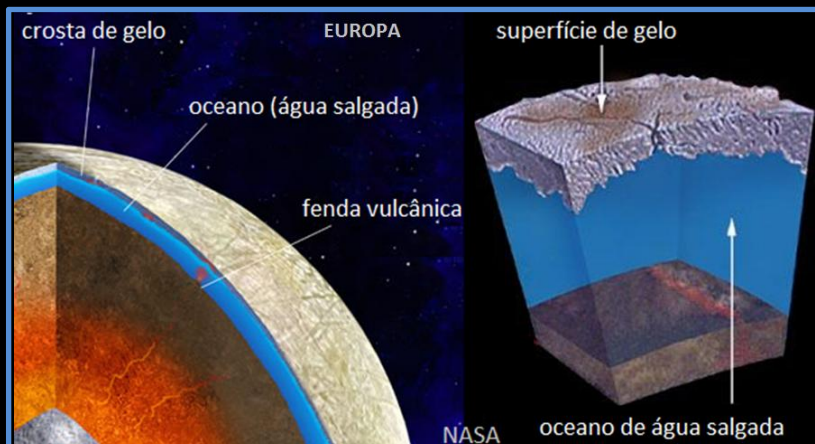
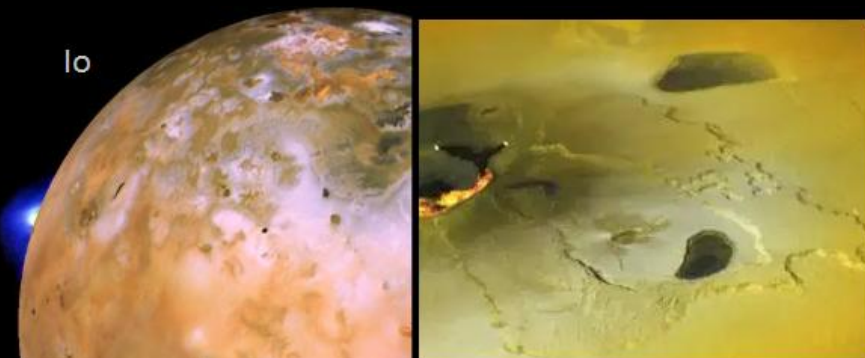
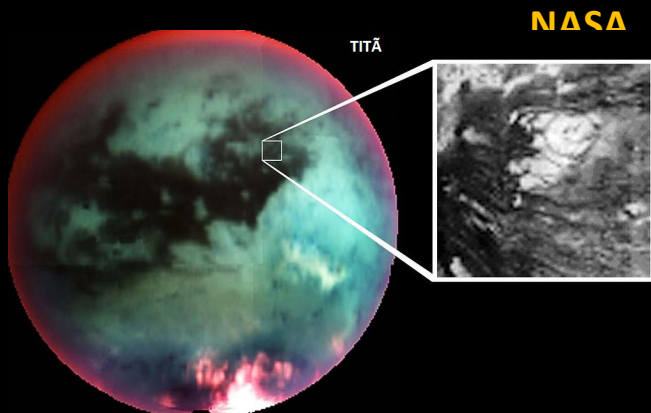
Miranda
Uranus



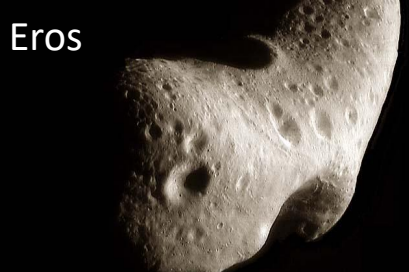
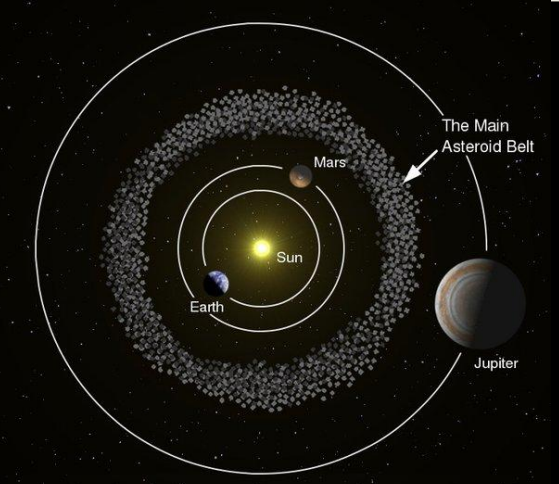
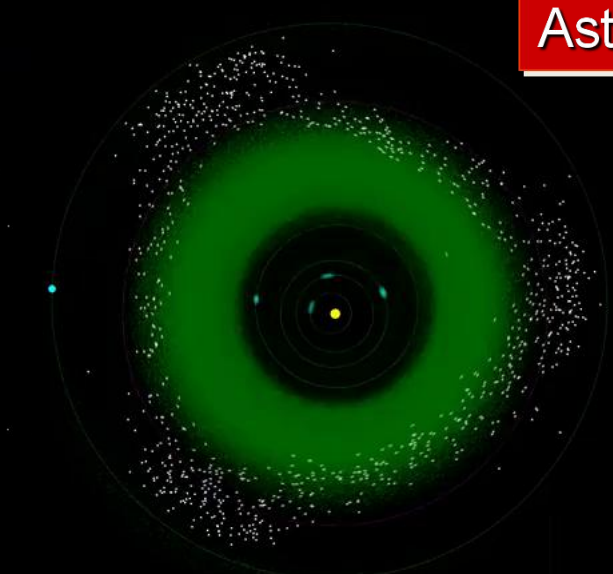
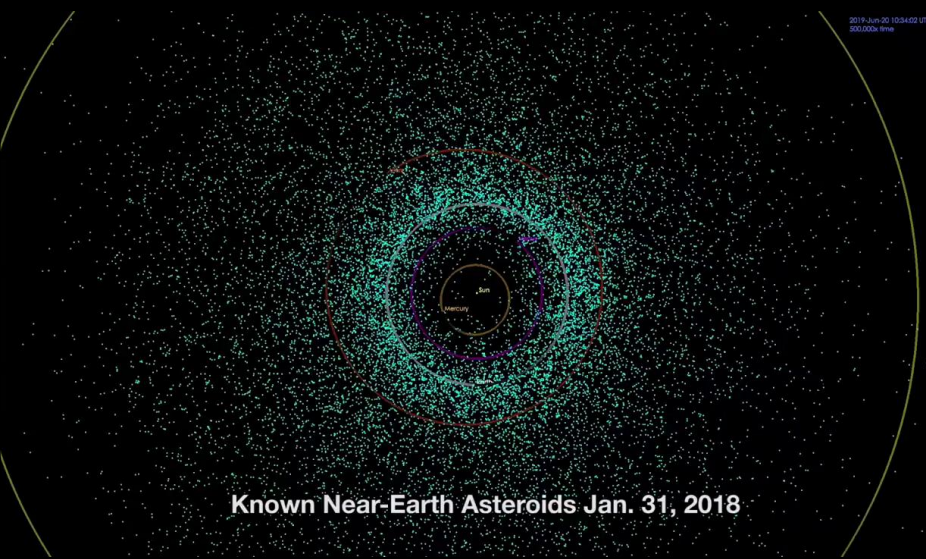
Proteus
Neptune



Mimas
Saturn



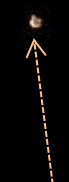
Asteroides



Eros



Itokawa



Dáctilo



Gaspra

Os maiores corpos do cinturão principal de asteroides



Planeta anão

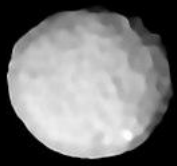
Ceres

939 km



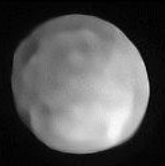
Vesta

525 km



Pallas

512 km



Hygiea

434 km

Asteroides



Vesta

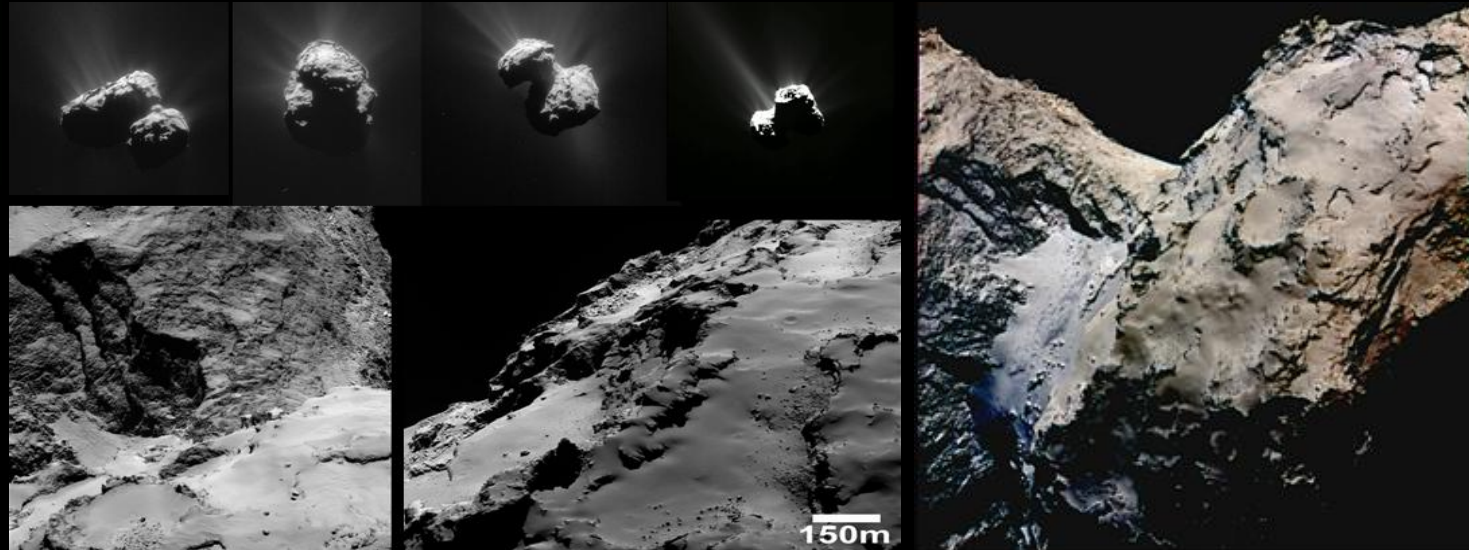
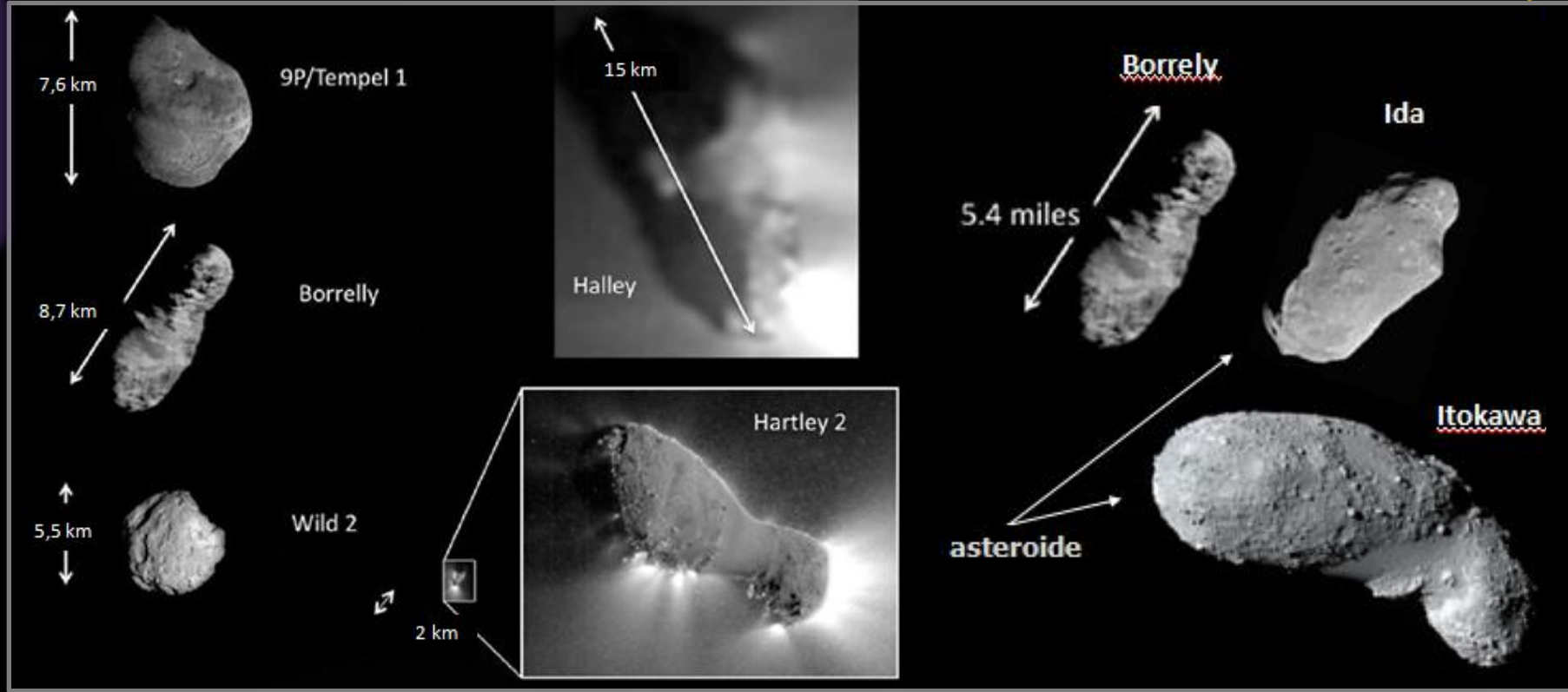


Ryugu: Imagens da sonda japonesa Hayabusa

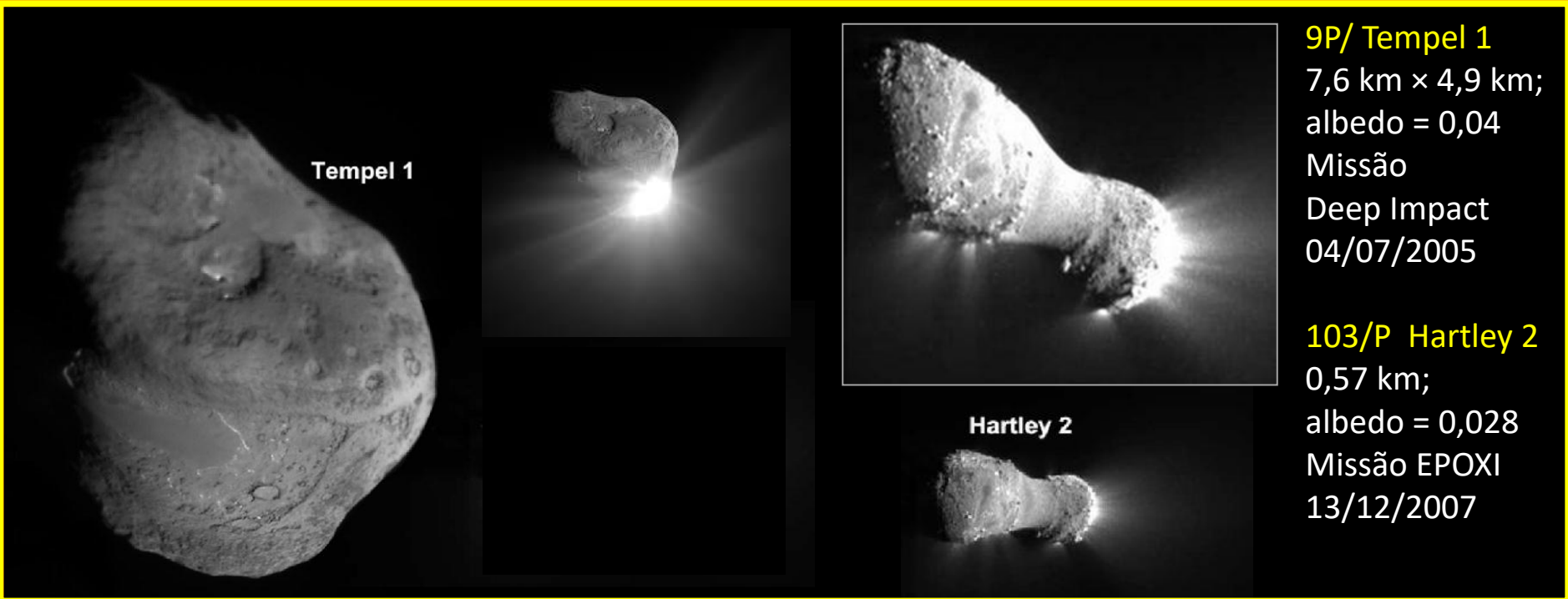


Cometas

67P/Churyumov-Gerasimenko



Núcleos de cometas

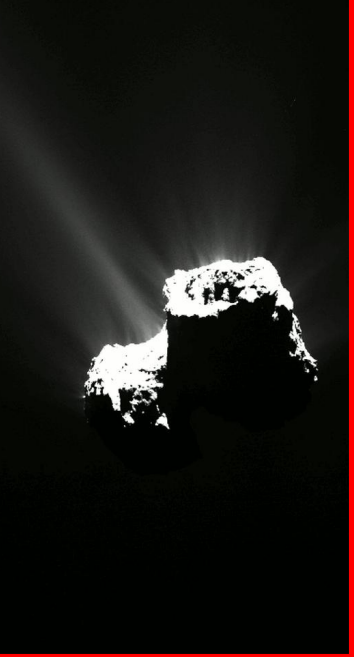
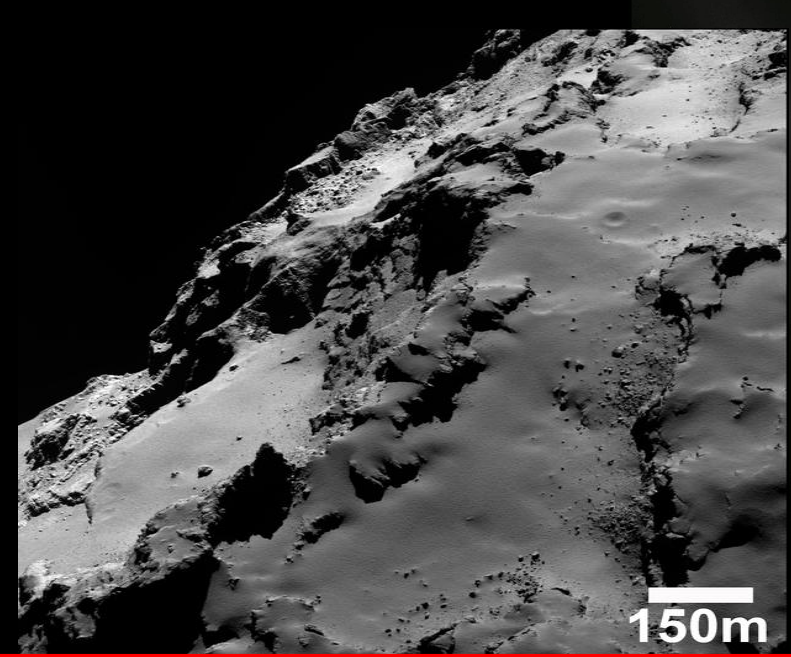
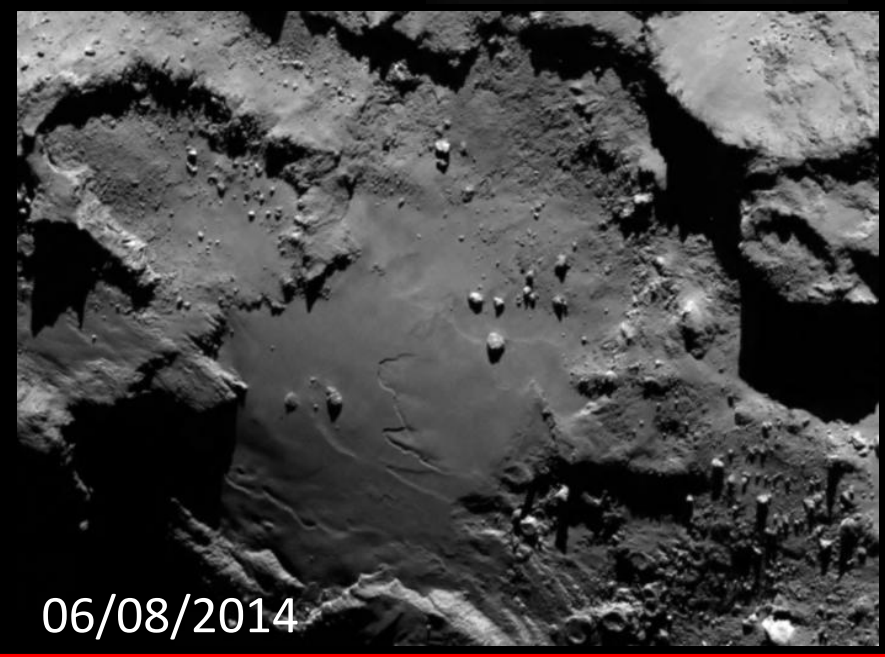
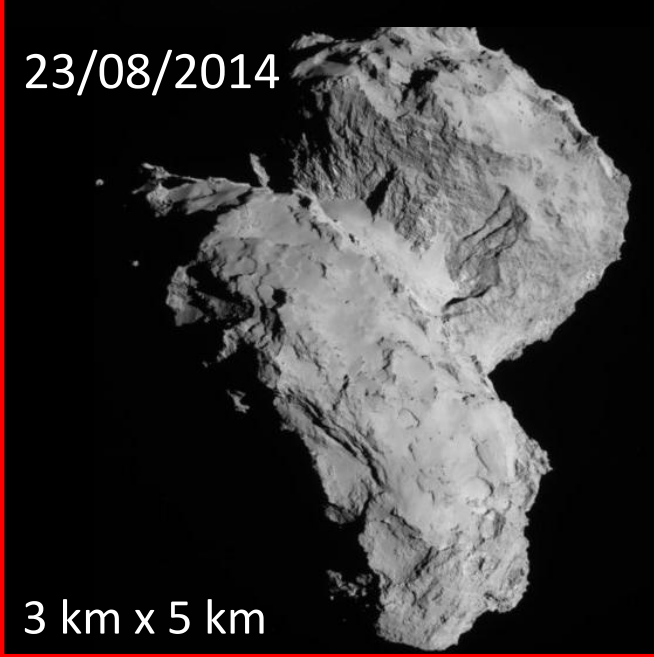


Tempel 1

Hartley 2

9P/ Tempel 1
7,6 km × 4,9 km;
albedo = 0,04
Missão
Deep Impact
04/07/2005

103/P Hartley 2
0,57 km;
albedo = 0,028
Missão EPOXI
13/12/2007

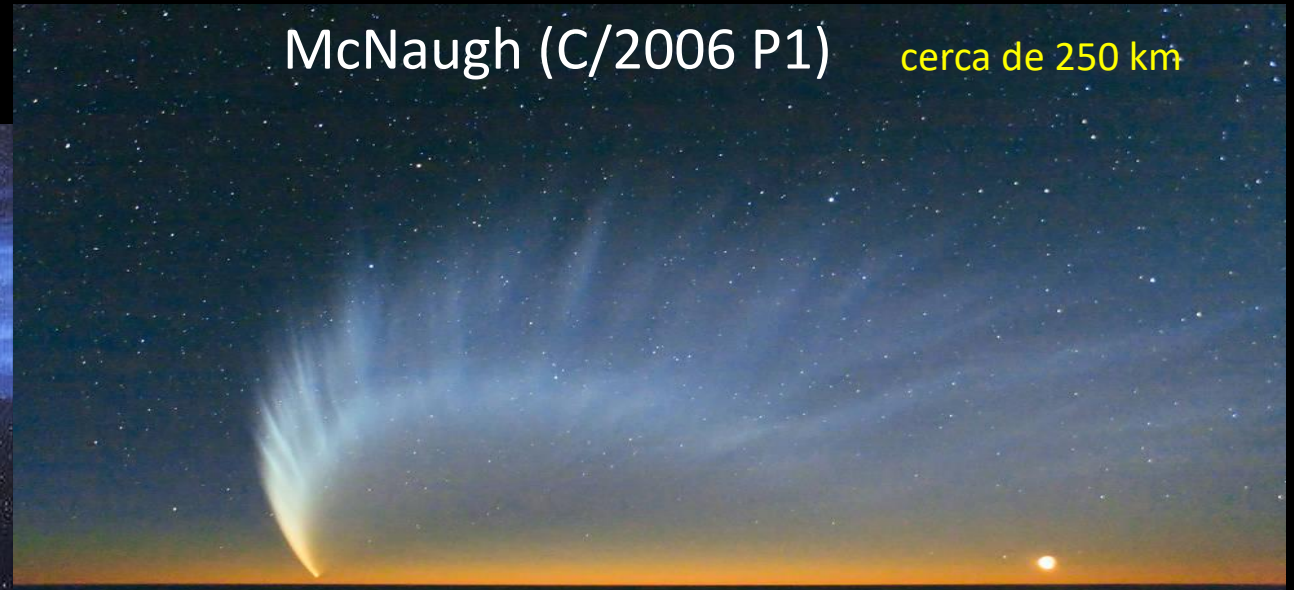


Alguns exemplos de grandes cometas

Leonard (C/2021 A1) **cerca de 1 km**



McNaugh (C/2006 P1) **cerca de 250 km**

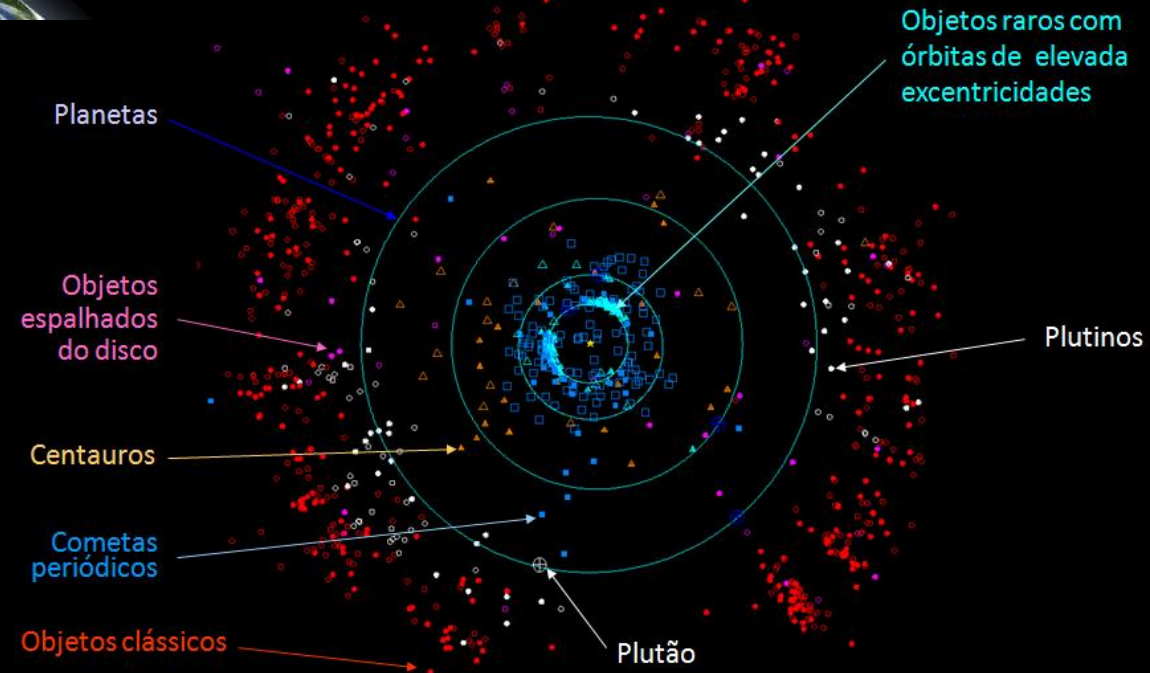
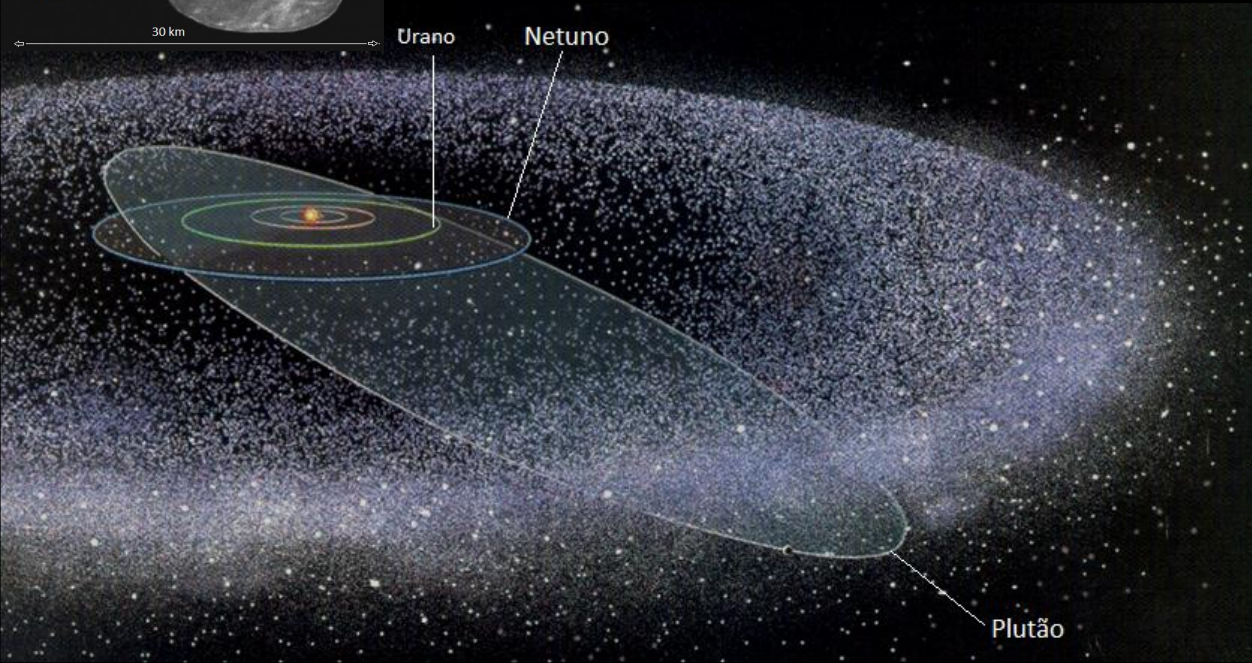
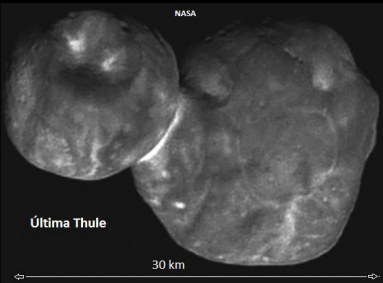
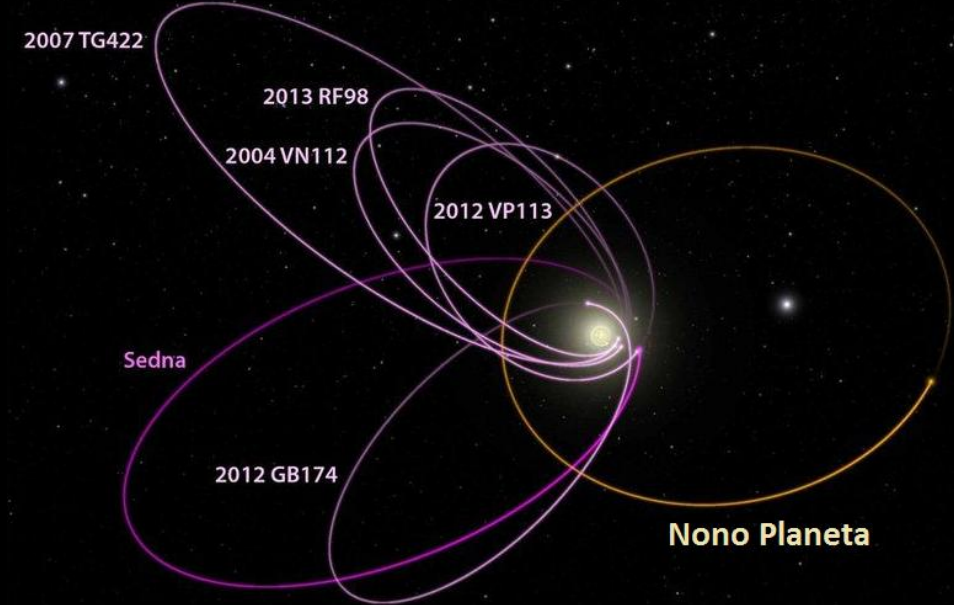
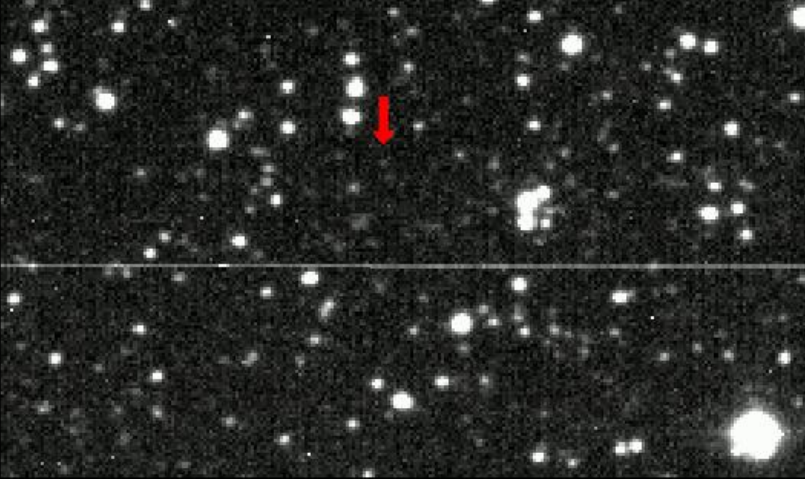


West (C/1975 V1) **menor que 10 km**



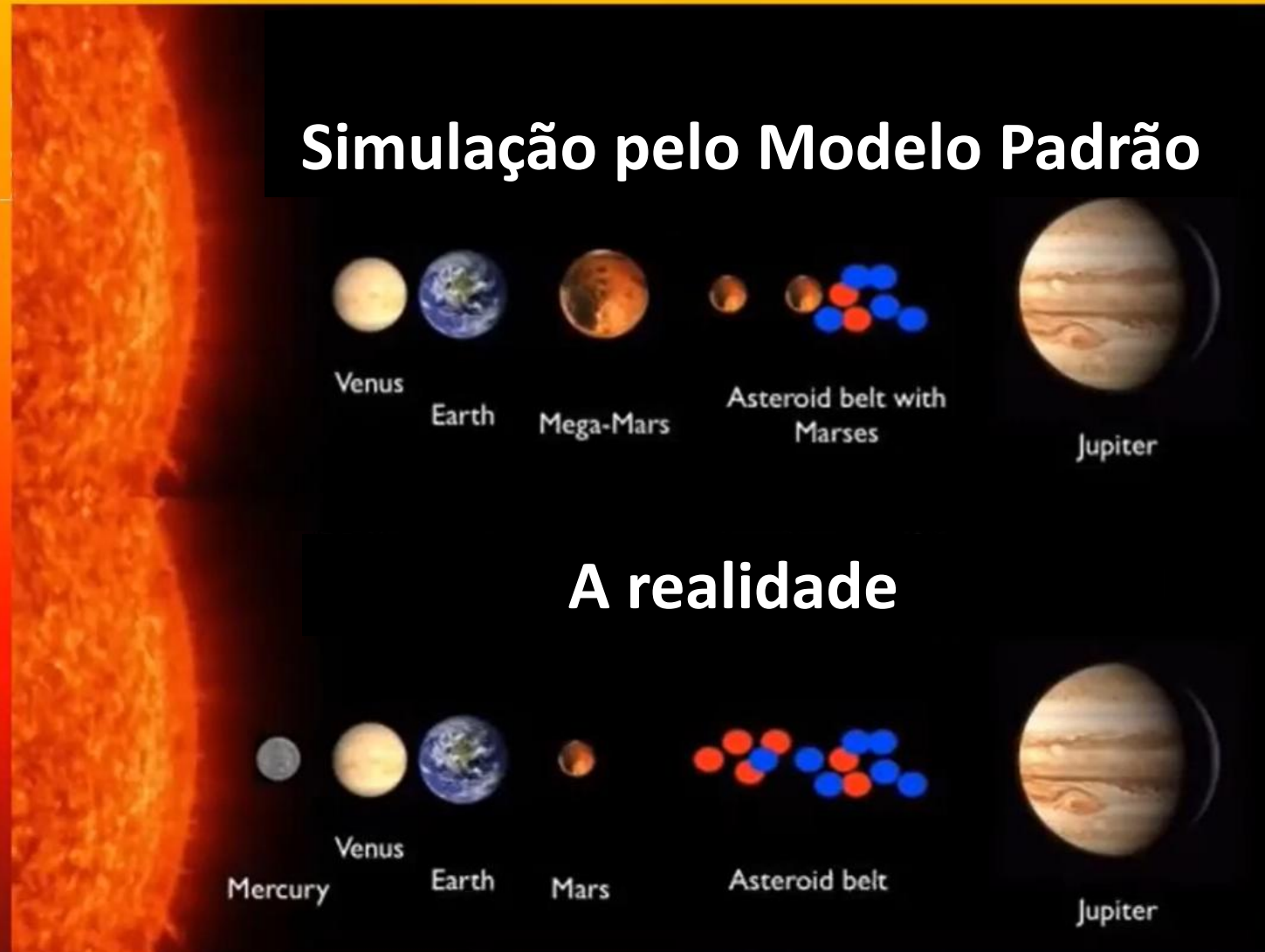
C/2014 UN271 (Bernardinelli-Bernstein)
Diâmetro **120 km?** ; Afélio 39,3 UA ; Periélio 10,9 UA (Jan 2031)
Período 2,75 milhões de anos

Objetos do Cinturão de Kuiper

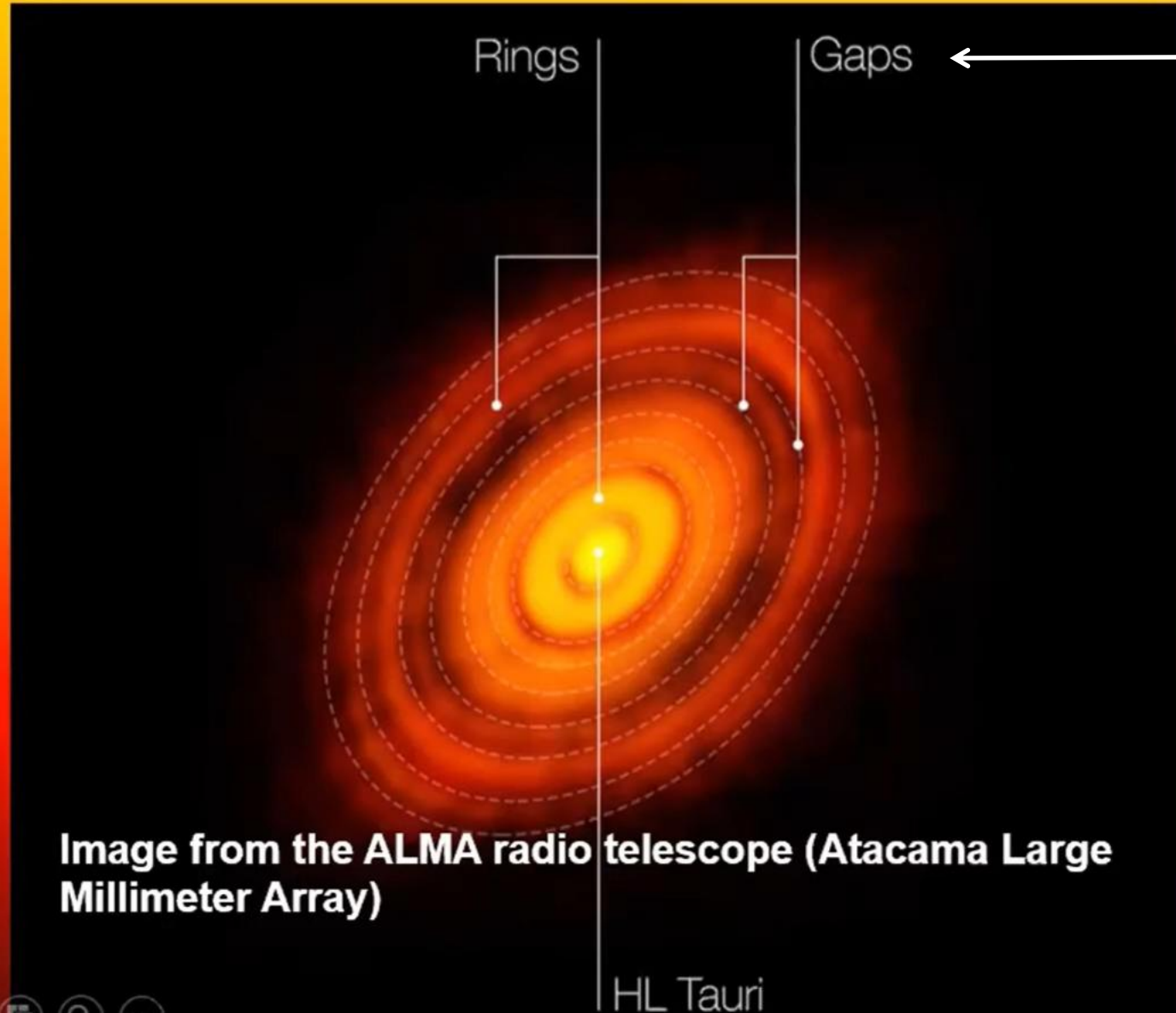


Plot prepared by the Minor Planet Center (2002 Oct.23).

Problemas com as simulações computacionais



Um Sistema Exoplanetário em formação



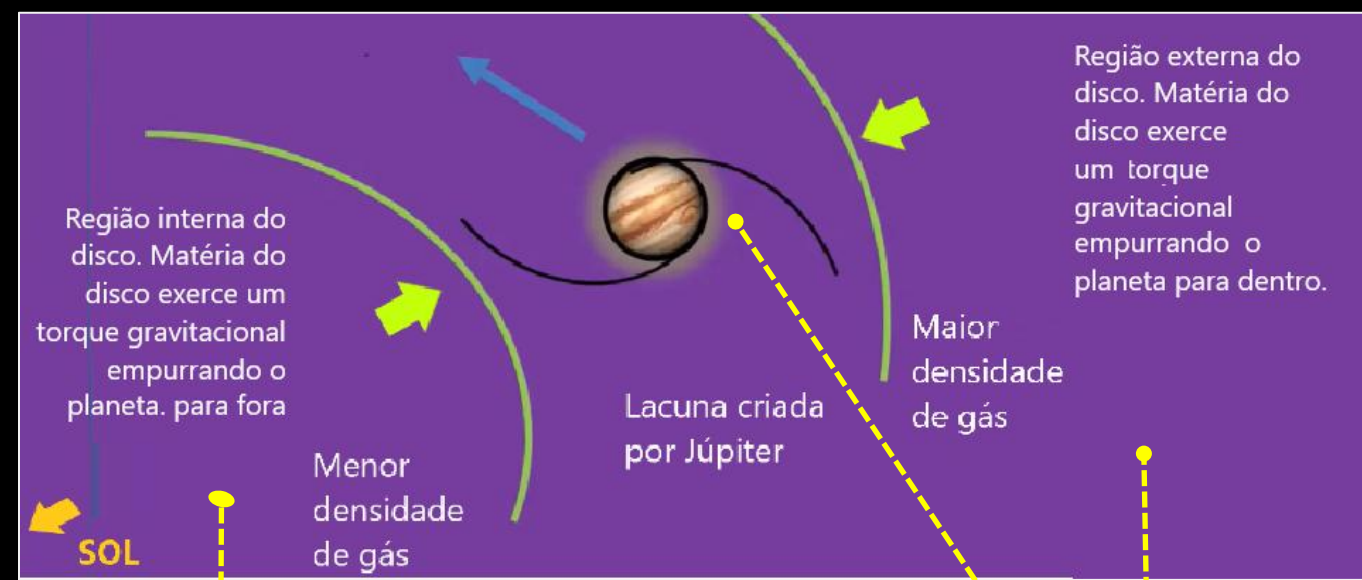
← onde formam-se os planetas

66 antenas:
54 de 12 m de diâmetro +
12 de 7 m de diâmetro
(área coletora total: 26.276 m²)



Modelo da Grande Aderência (Grande Virada)

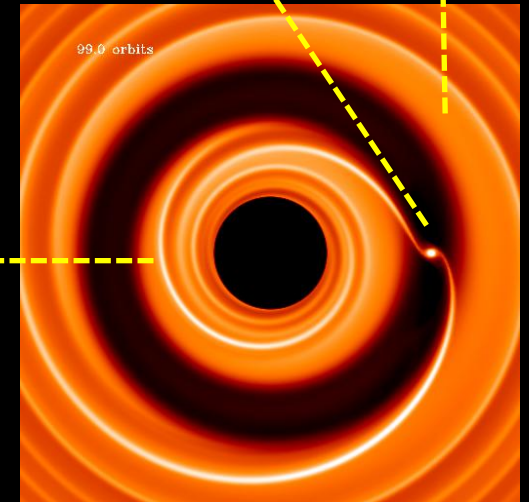
Júpiter se formou a uma distância de 3,5 UA do Sol. A interação gravitacional com a matéria do disco protoplanetário fez Júpiter migrar para dentro até para 1,5 UA, antes de reverter o curso devido à captura de Saturno em uma ressonância orbital, eventualmente parando perto de sua órbita atual em 5,2 UA.



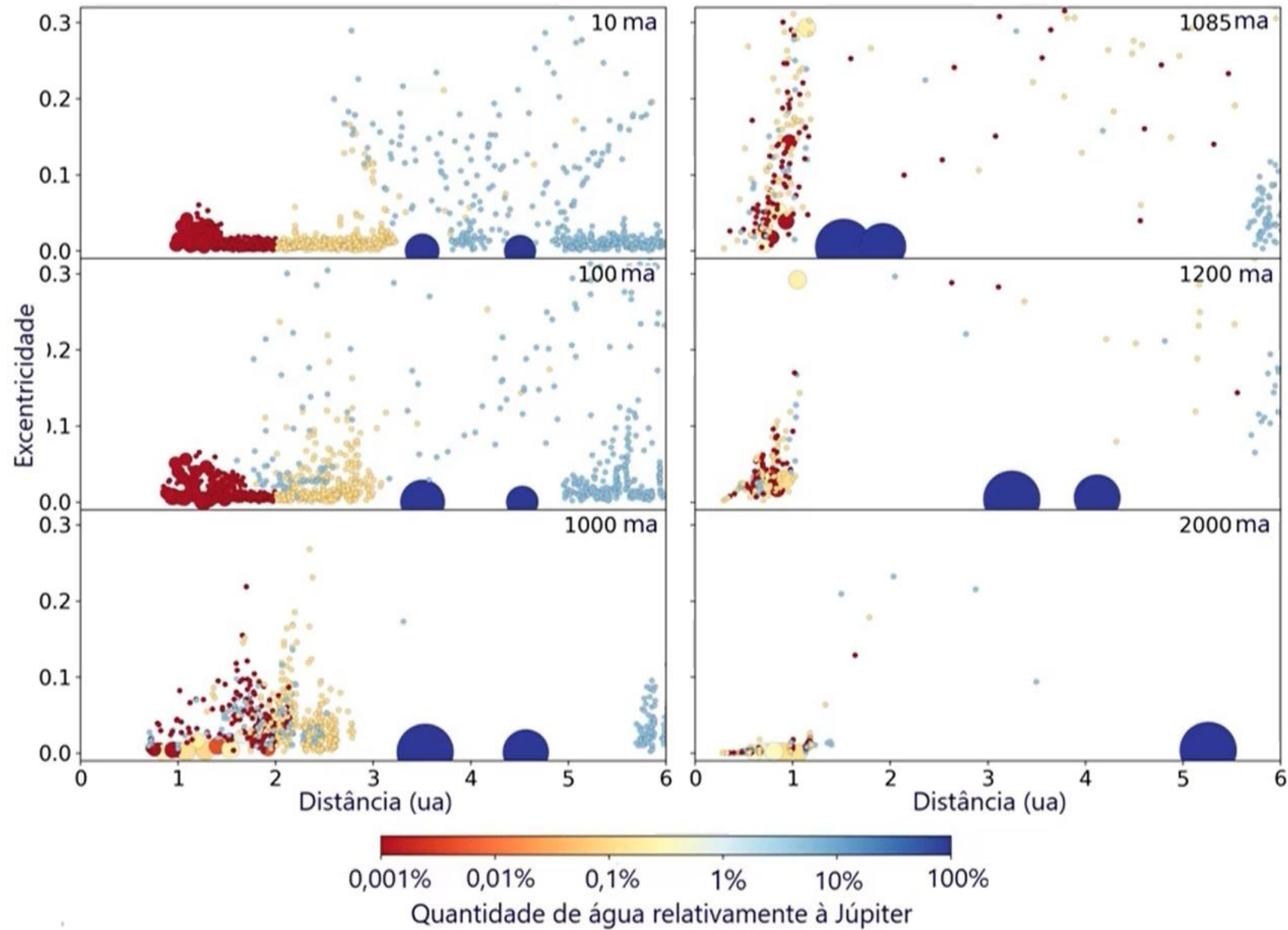
Júpiter e Saturno em formação

Júpiter e Saturno formados

Urano e Nutuno



Adaptado de arXiv:2302.00649 [astro-ph.EP]



MUITAS QUESTÕES ESTÃO SEM RESPOSTAS.

AS MAIS EVIDENTES:

- **Por que não há “Júpiteres Quentes” nem “Super Terras” no Sistema Solar?**
- **Por que Marte é tão pequeno? Era de se esperar um planeta maior do que a Terra.**
- **Por que não há um grande planeta rochoso no local do Cinturão Principal de Asteroides?**
- **Por que as órbitas dos planetas são quase circulares e coplanares?**
Era de se esperar o oposto.

SÃO CARACTERÍSTICAS DOMINANTES NOS SISTEMAS ESTELARES CONHECIDOS

Conclusão: O Sistema Solar e, em especial, a Terra parecem ser casos incomuns.

**Terra antes
da
vida?**



Vida primitiva ?

<https://epicazzio.blogspot.com/>



Galatea - Um Espaço Para A Astronomia

A intenção deste blog é discutir de forma objetiva assuntos de Astronomia, com ênfase em Ciências Planetárias.

Vamos Falar De Astronomia?

CANAL YOUTUBE

Onde está o centro? Uma discussão que durou 23 séculos. Parte 1. Introdução.



ENOS PICAZZIO - março 11, 2024



Em 1632, sob uma licença formal da Inquisição, Galileu Galilei publicou seu famoso livro "Diálogo sobre os dois principais sistemas do mundo". De forma muito competente, Galileu compara o sistema heliocêntrico de Copérnico, com o tradicional sistema geocêntrico de Ptolomeu. No ano seguinte, em 1633, o livro foi incluído no Índice de Livros Proibidos e Galileu foi considerado "veementemente suspeito de heresia". O preço pela heresia foi muito alto. Galileu ficou em pris...



Postar um comentário

[LEIA MAIS »](#)