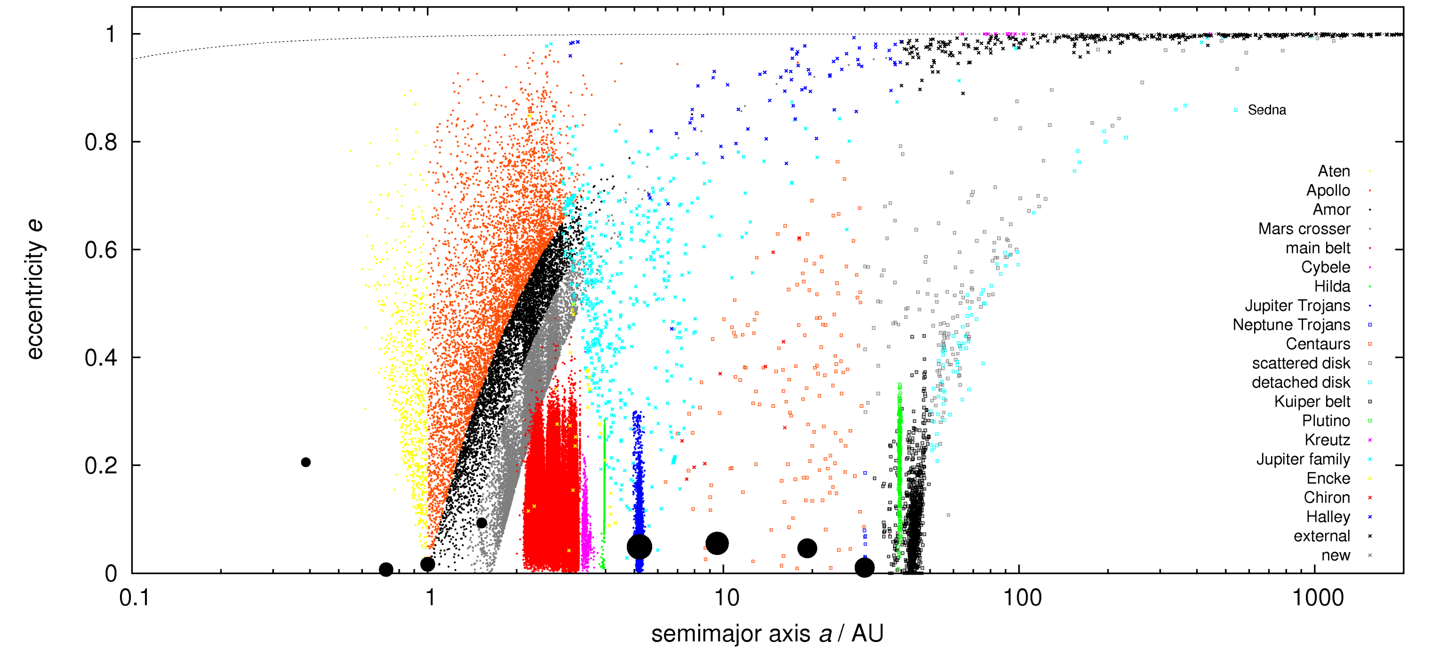
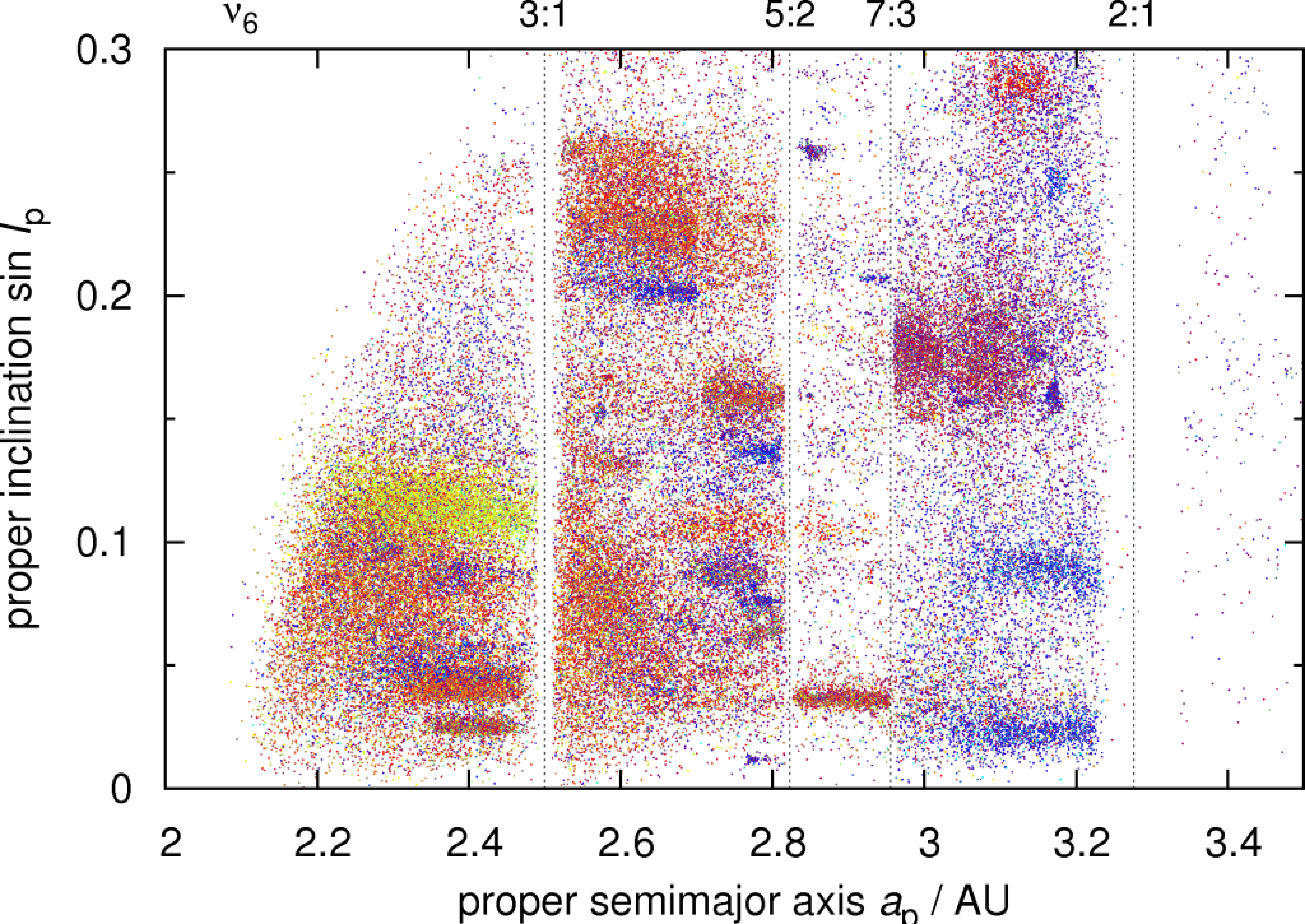
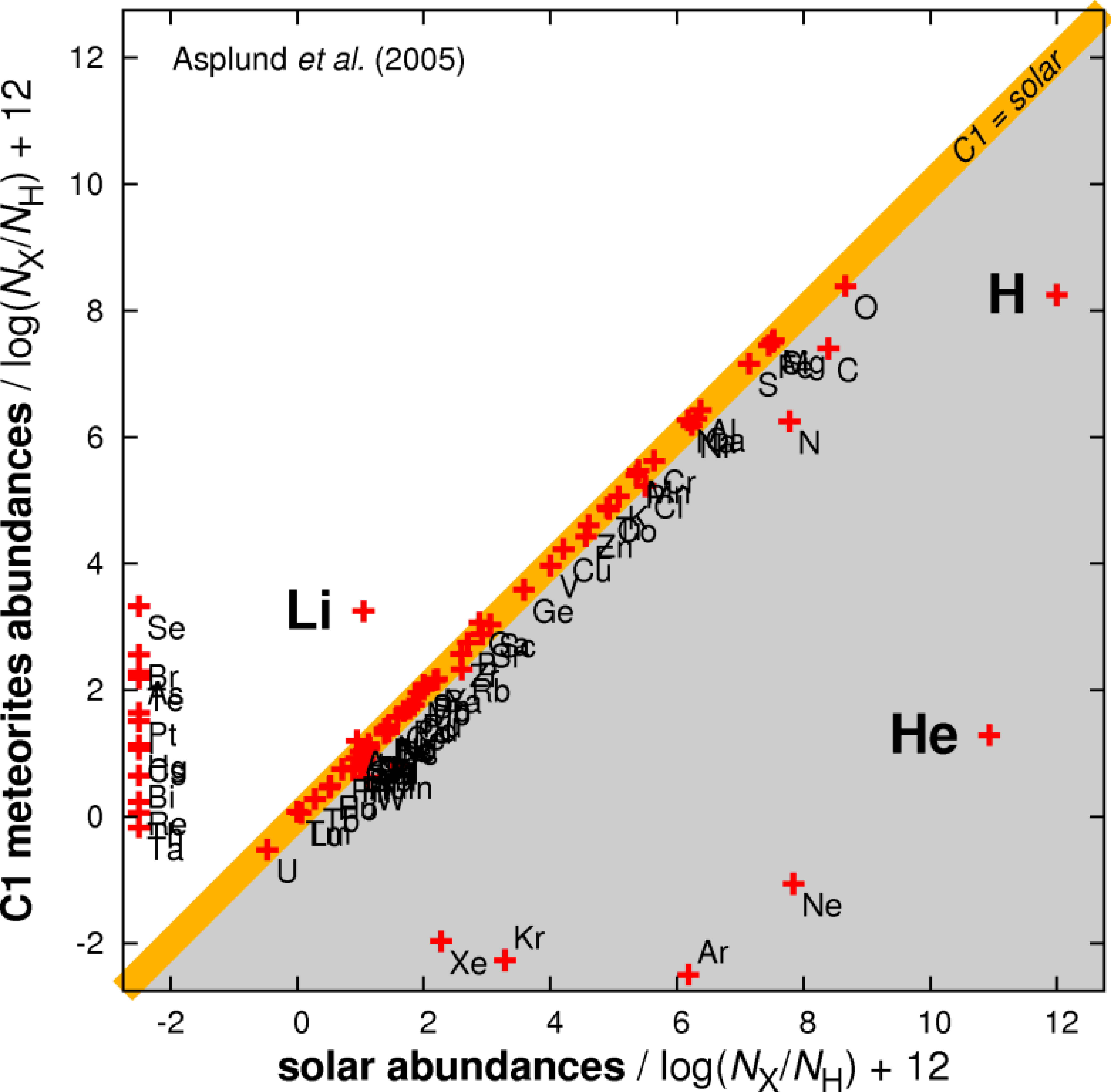


eccentricity e
semimajor axis a / AU
1
0.8
0.6
0.4
0.2
0
0.1
1
10
100
1000
Sedna
Aten
Apollo
Amor
Mars crosser
main belt
Cybele
Hilda
Jupiter Trojans
Neptune Trojans
Centaurs
scattered disk
detached disk
Kuiper belt
Plutino
Kreutz
Jupiter family
Encke
Chiron
Halley
external
new

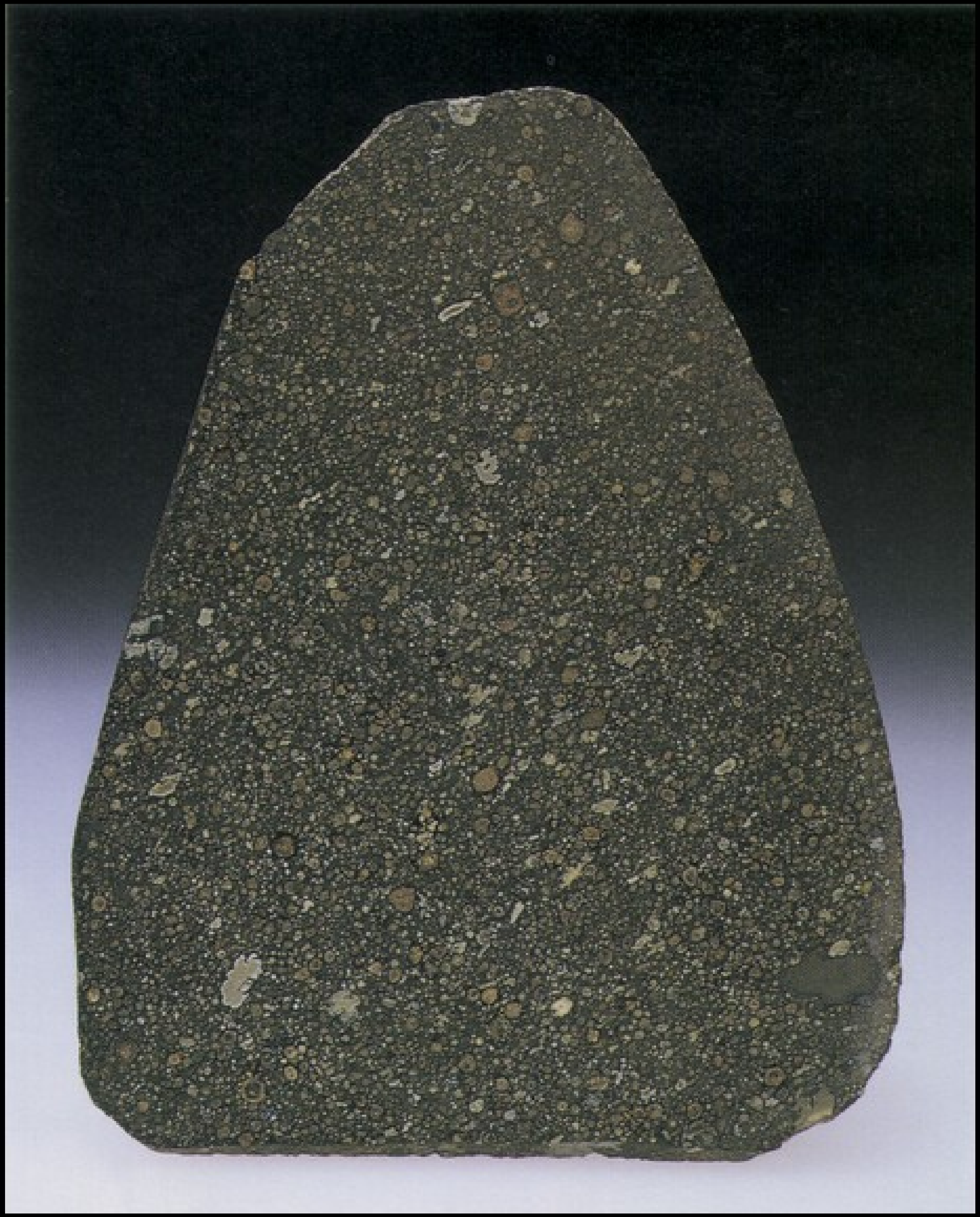


ν6
3:1
5:2
7:3
2:1
0.3
0.2
0.1
0
2
2.2
2.4
2.6
2.8
3
3.2
3.4
proper inclination sin I_p
proper semimajor axis a_p / AU

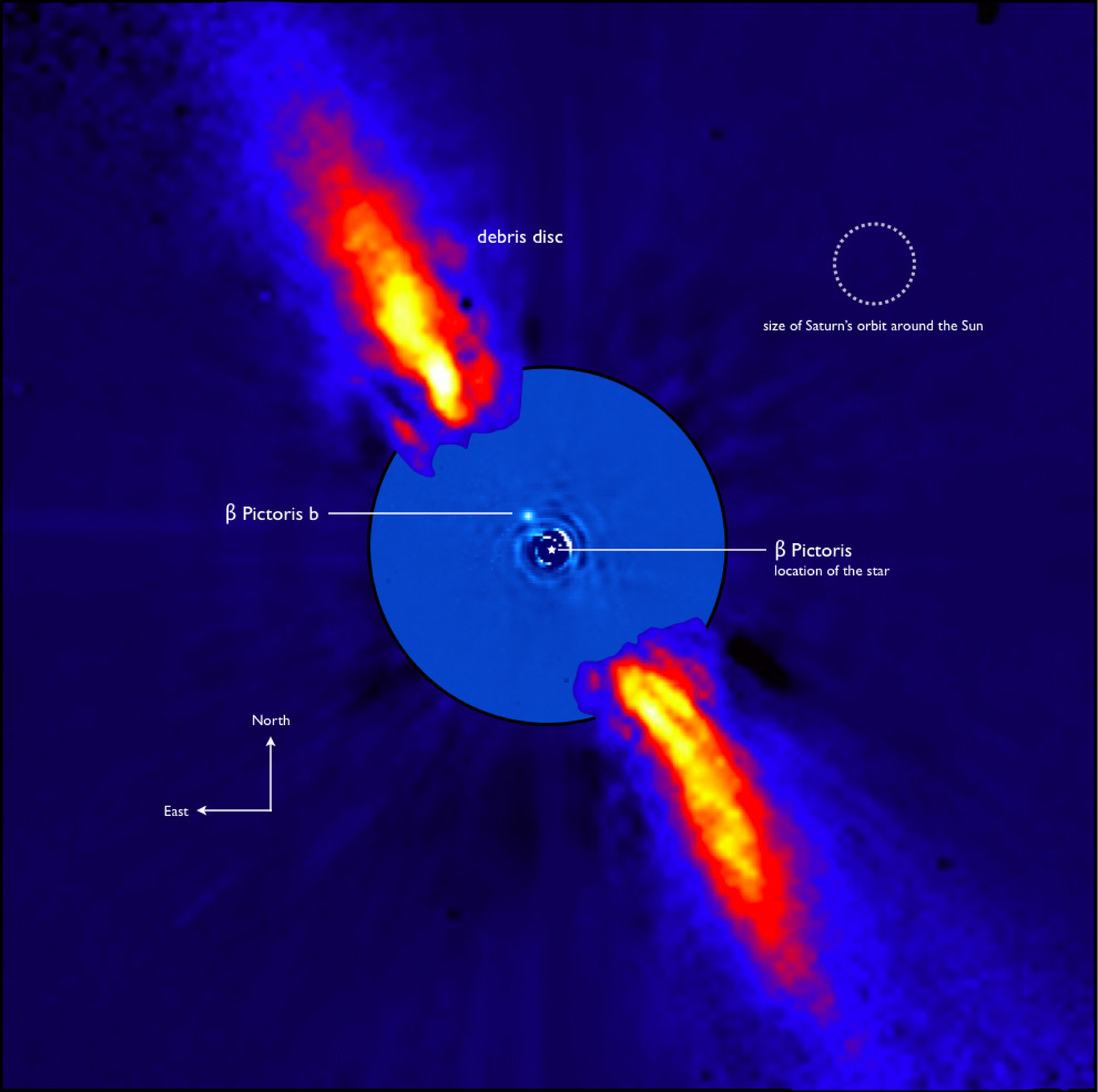

YOU ARE HERE



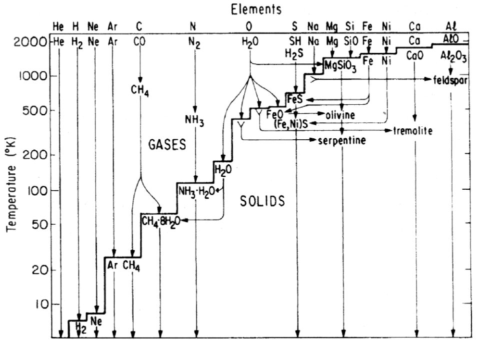
Asplund et al. (2005)
C1 = solar
C1 meteorites abundances / log(N_X/N_H) + 12
solar abundances / log(N_X/N_H) + 12
H
He
Li
O
C
N
S
Ne
Ar
Kr
Xe
U
Ge
V
Cu
Cl
Cr
Rb
Se
Br
Pt
Bi
Ta
Lu



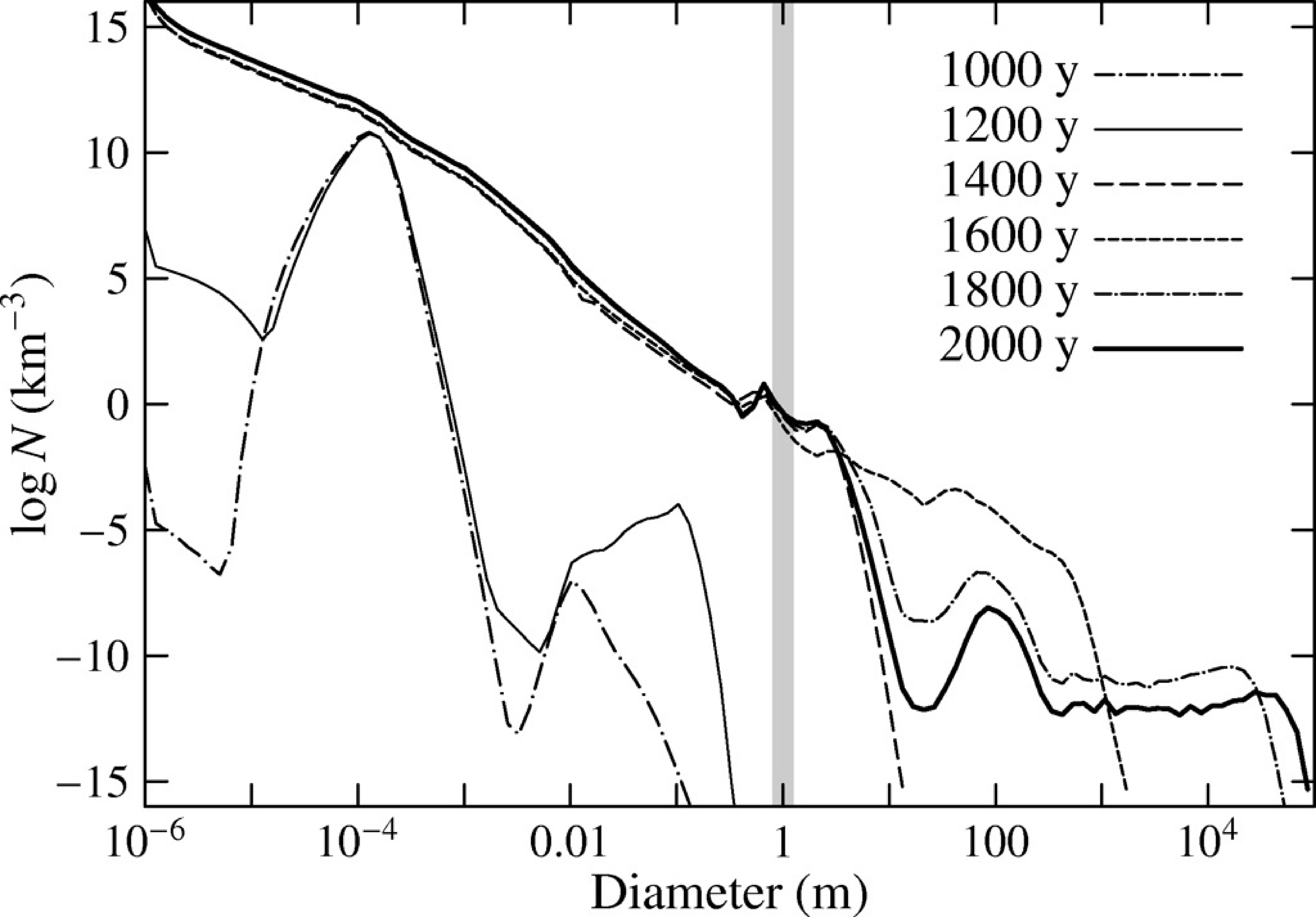
Venus
Earth
Mercury
Mars
Asteroids
Jupiter
Saturn
Uranus
Neptune
Kuiper A
Kuiper B
?
?
$\propto r^{-3/2}$
10000
1000
100
10
1
0.1
0.01
0.001
0.0001
1
10
100
σ (g/cm^2)
r (AU)



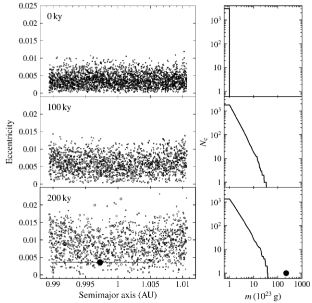
debris disc
size of Saturn's orbit around the Sun
β Pictoris b
β Pictoris
location of the star
North
East



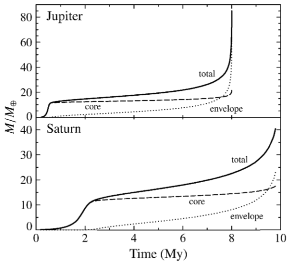
Elements
He H Ne Ar C N O S Na Mg Si Fe Ni Ca Aℓ
He H2 Ne Ar CO N2 H2O SH Na Mg SiO Fe Ni Ca AℓO
H2S
MgSiO3 Fe Ni CaO Al2O3
CH4
feldspar
FeS
NH3
FeO
olivine
(Fe,Ni)S
tremolite
GASES
serpentine
H2O
NH3·H2O
SOLIDS
CH4·8H2O
Ar CH4
H2 Ne
Temperature (°K)
2000
1000
500
200
100
50
20
10



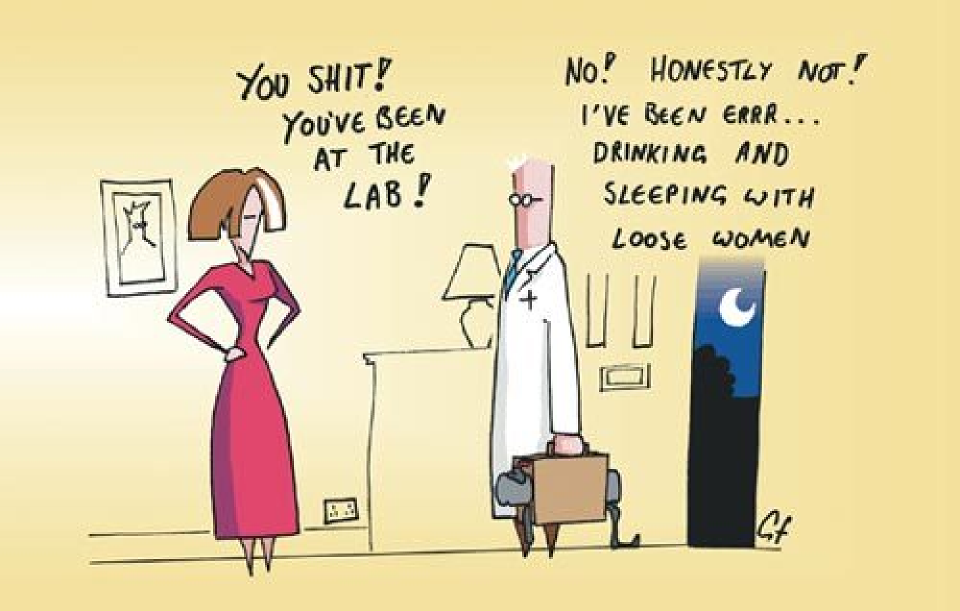
1000 y
1200 y
1400 y
1600 y
1800 y
2000 y
15
10
5
0
−5
−10
−15
log N (km−3)
10−6
10−4
0.01
1
100
10^4
Diameter (m)

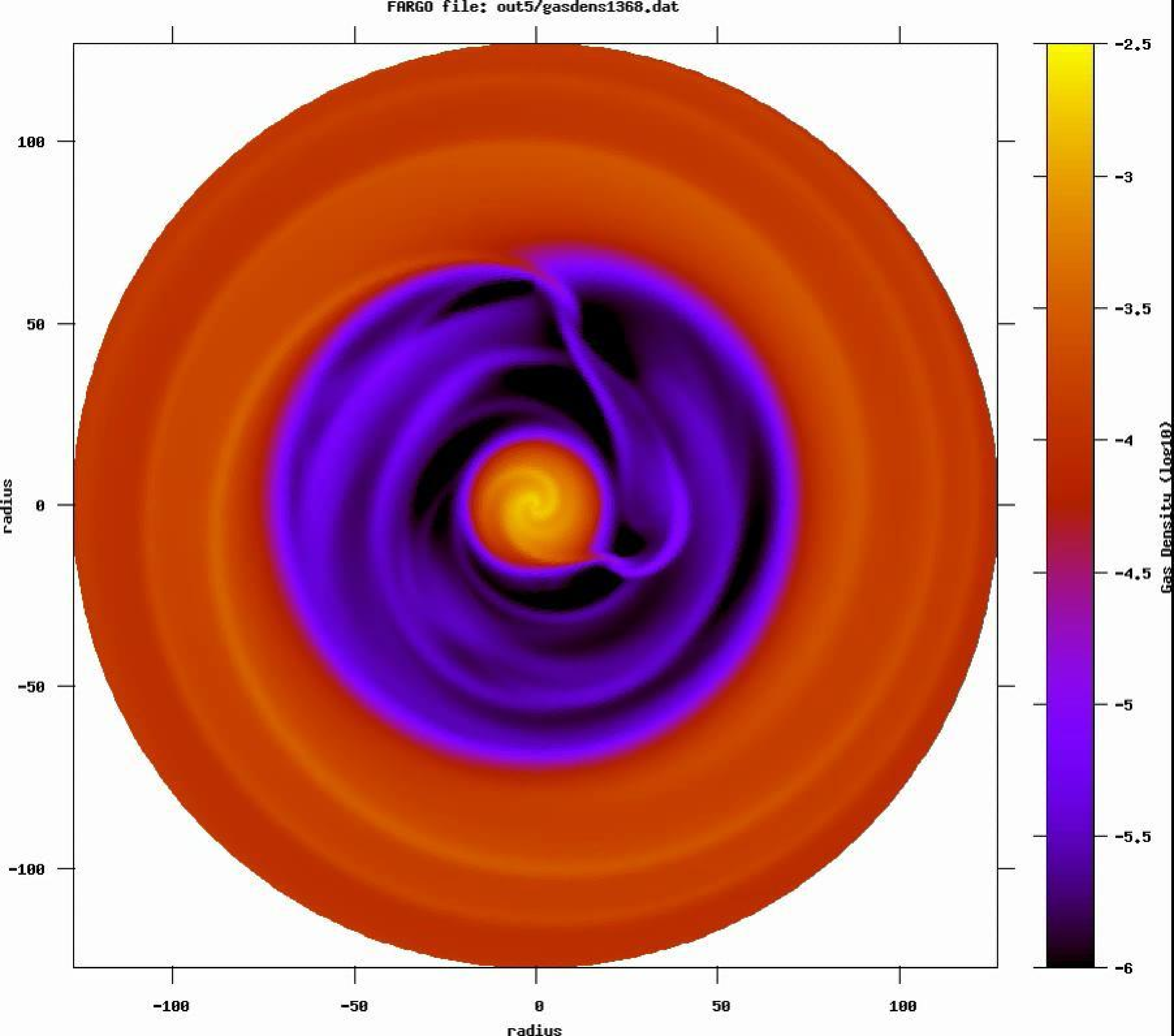


Obr. 13 — Vznik planetárního embrya z planetesimál. Vlevo závislost excentricity e dráhy planetesimál na velké poloose a, vpravo rozdělení velikostí souboru planetesimál. Časová škála vývoje je 10^6 let. Převzato z [1], Kokubo a Ida (2000).

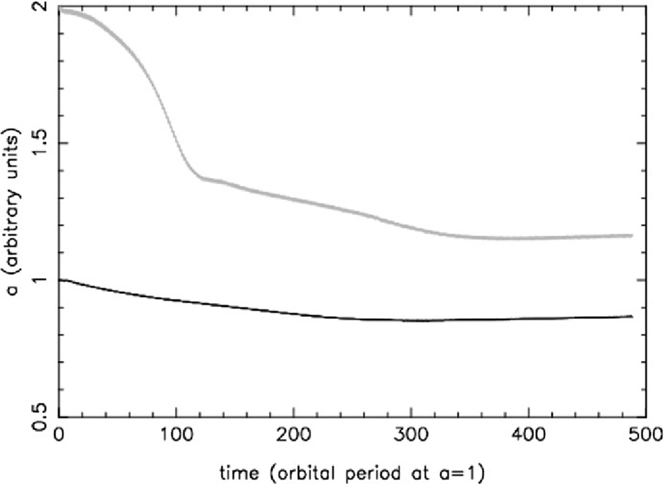


Obr. 16 — Hmotnost Jupiteru a Saturnu v závislosti na čase. Odlišeno je jádro z pevných látek (čárkovaně) a plynná obálka (tečkovaně). Převzato z [1], Pollack aj. (1996).


YOU SHIT! YOU'VE BEEN AT THE LAB!
NO! HONESTLY NOT! I'VE BEEN ERRR... DRINKING AND SLEEPING WITH LOOSE WOMEN



FARGO file: out5/gasdens1368.dat
radius
radius
100
50
0
-50
-100
-100
-50
0
50
100
Gas Density (log10)
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6



a (arbitrary units)
0.5
1
1.5
2
0
100
200
300
400
500
time (orbital period at a=1)

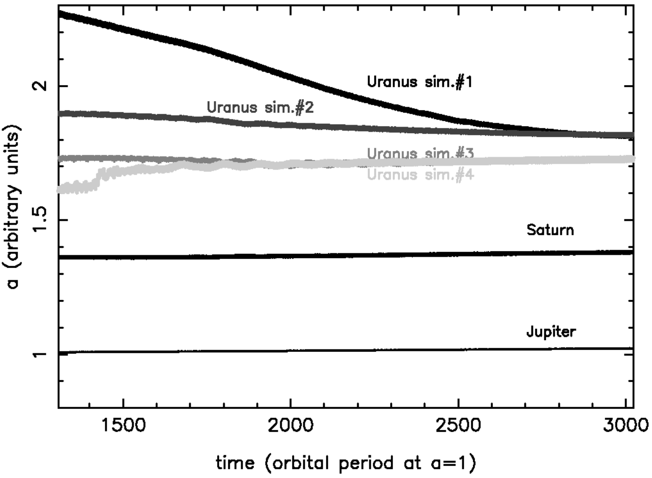
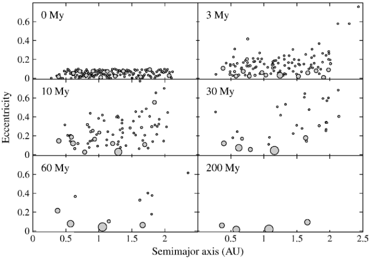
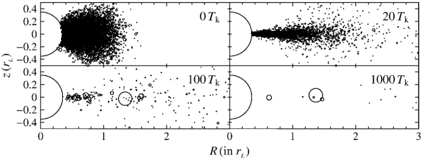


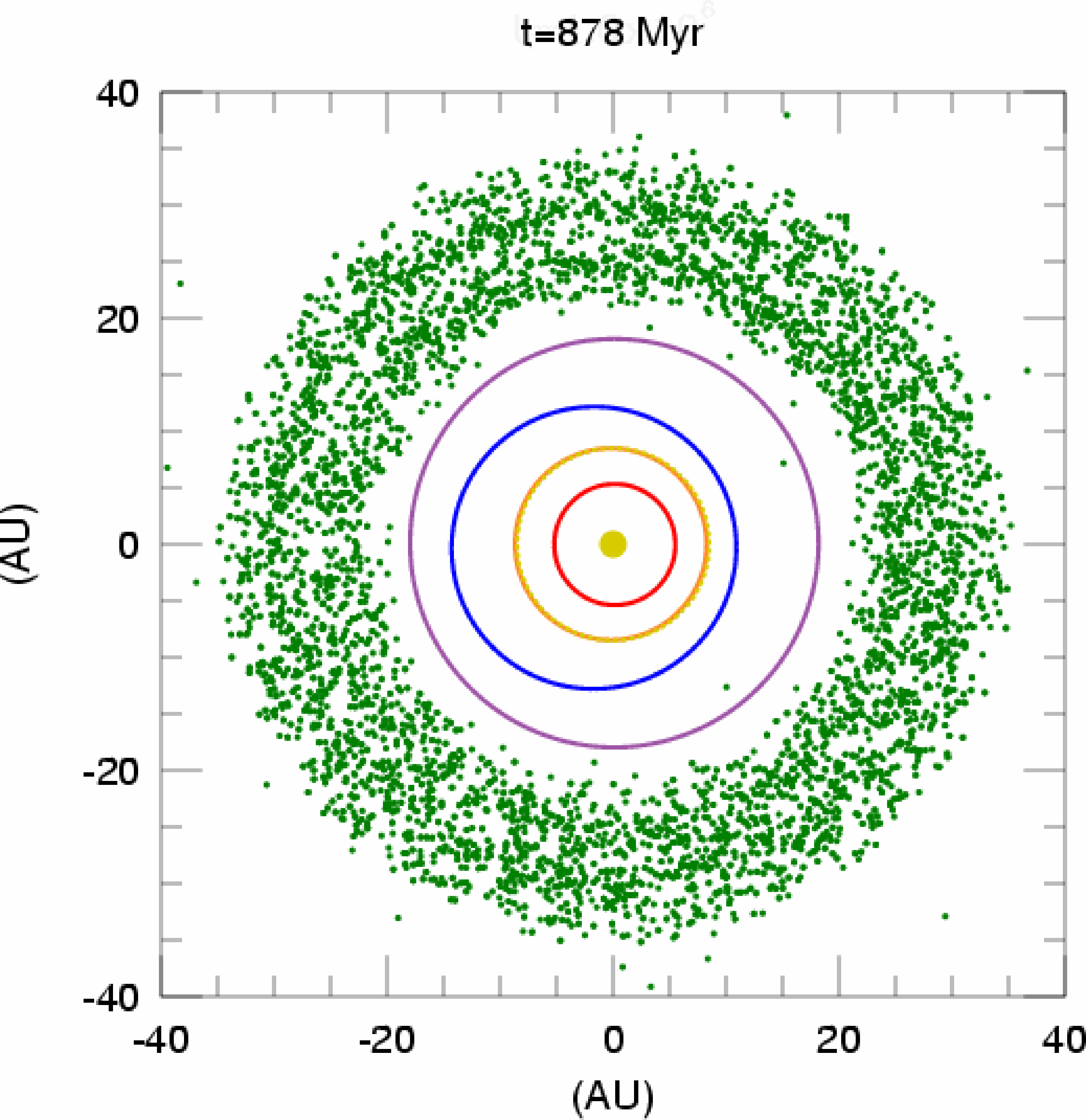
FIG. 2.—Evolution of Uranus, after it was added to the simulation presented in Fig. 1. Four simulations are presented. In the first (*black curve*) Uranus is started beyond the 1:2 MMR with Saturn. During its inward migration it passes across the 1:2 MMR and eventually gets trapped into the 2:3 MMR. In the second simulation (*dark-gray curve*) Uranus is introduced between the 2:3 and 1:2 MMRs with Saturn. Again, Uranus gets captured into the 2:3 MMR. In the third simulation (*medium-gray curve*) Uranus is started between the 3:4 and the 2:3 MMRs with Saturn and gets captured in the former. In the fourth simulation (*light-gray curve*) Uranus is started between the 4:5 and 3:4 MMRs and evolves outward until it is captured again in the 3:4 MMR. The evolution of Jupiter and Saturn is essentially the same in all the simulations, so we only present one example.



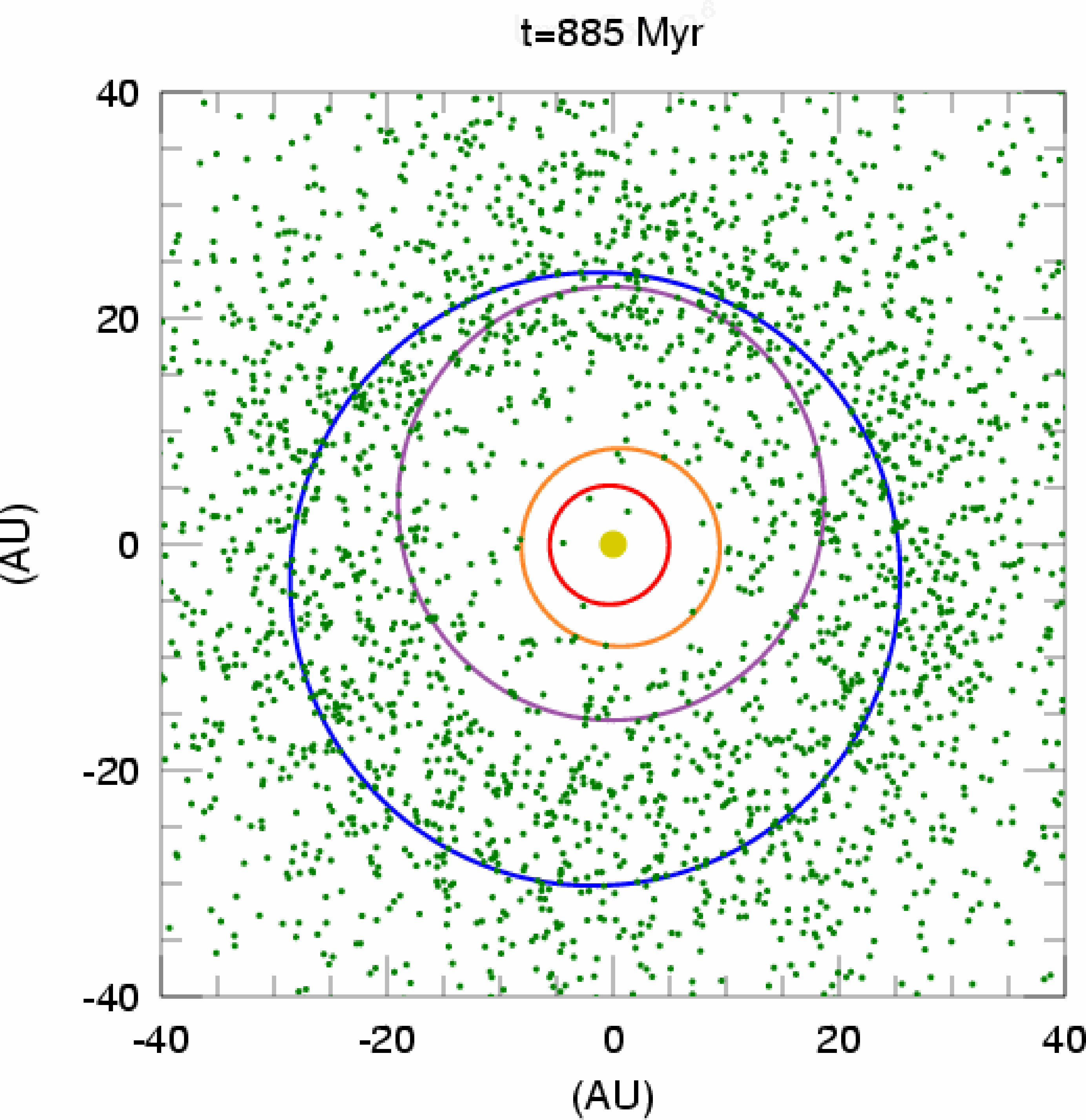
Obr. 14 — Formování terestrických planet z planetárních embryí. Časová škála je zde asi 10^6 let. Převzato z [1], Chambers (2001).



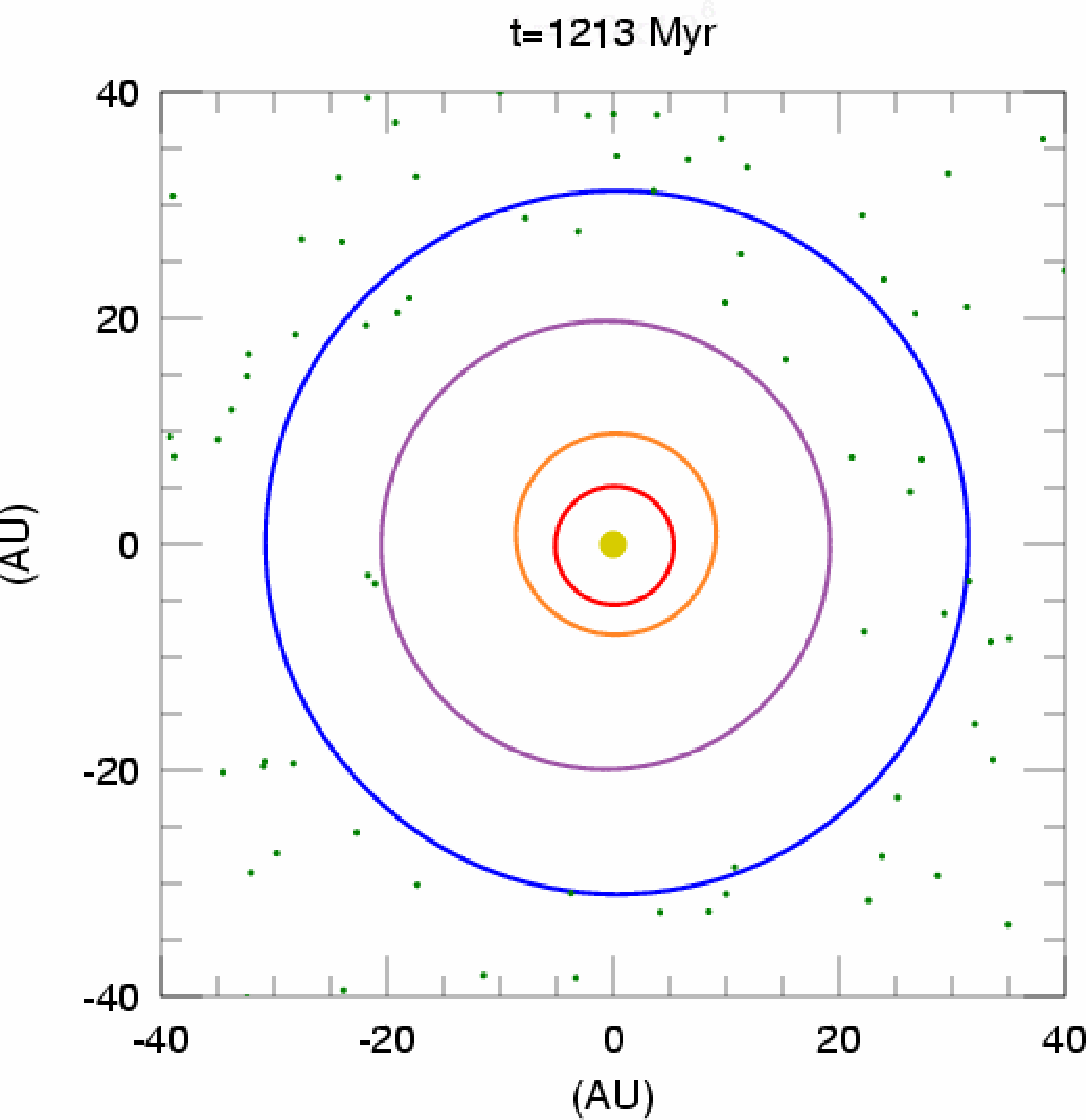
Obr. 15 — Model vzniku Měsíce v protolunárním disku obklopujícím Zemi po velkém impaktu. Vzdálenosti na osách jsou v jednotkách Rocheových poloměrů r_L; půlkružnice okolo počátku znázorňuje Zemi. Disk úlomků má zde hmotnost $0{,}4\,M_\oplus$ a rozkládá se v těsné blízkosti, jen několik zemských poloměrů daleko. Všech 10^4 částic je zobrazených v jedné rovině (R, z), i když ve skutečnosti jsou rozptýlené okolo Země. Jednotka času $T_k = 7$ h je keplerovská oběžná doba ve vzdálenosti r_L; dá se tedy říci, že „Měsíc vznikl asi za měsíc". (Za následující miliardy let způsobily gravitační slapy mezi Zemí a Měsícem vzdálení Měsíce od Země až na současných $60\,R_\oplus$.) Převzato z [1], Kokubo aj. (2000).



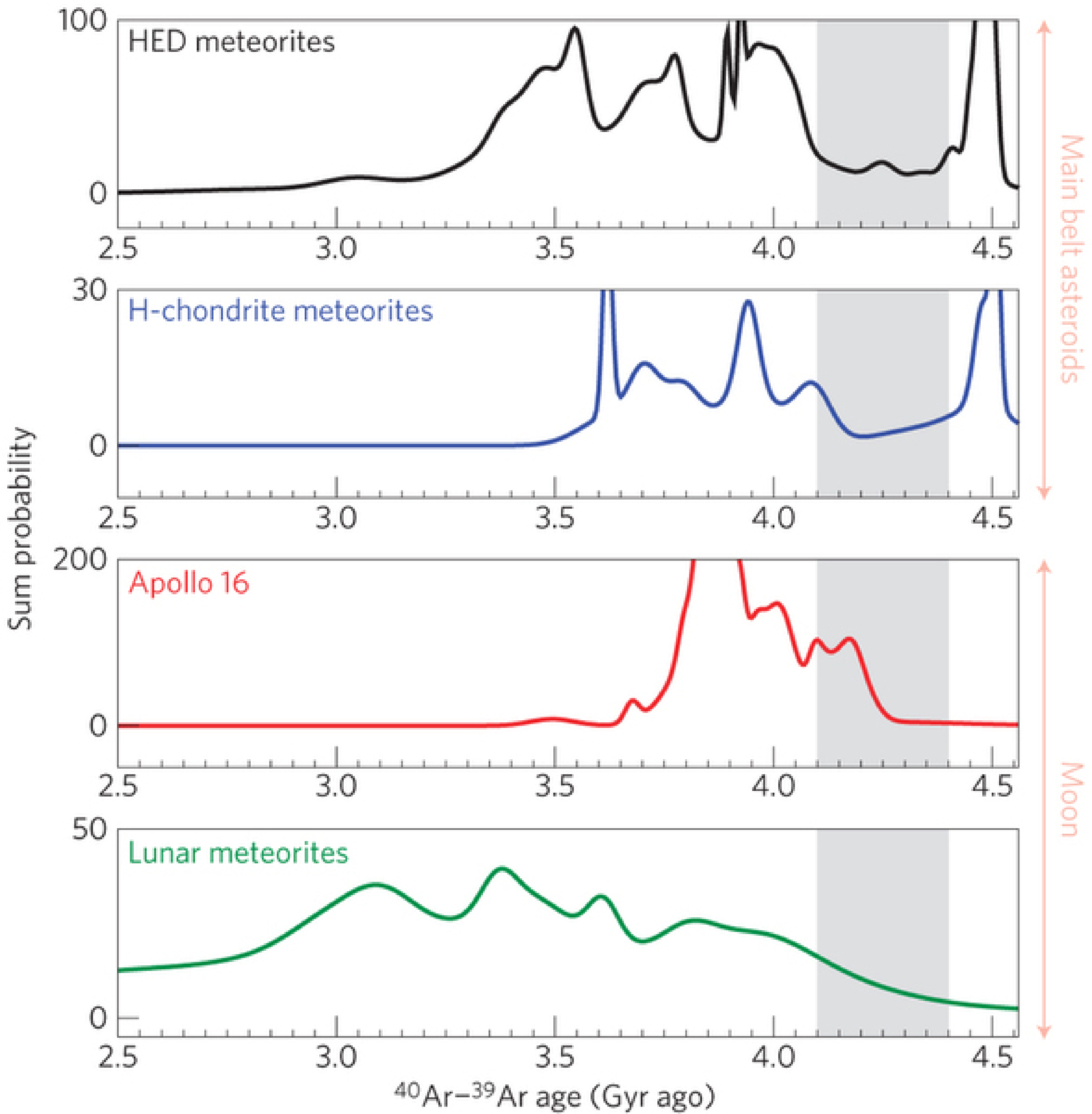
t=878 Myr
40
20
0
-20
-40
(AU)
-40
-20
0
20
40
(AU)



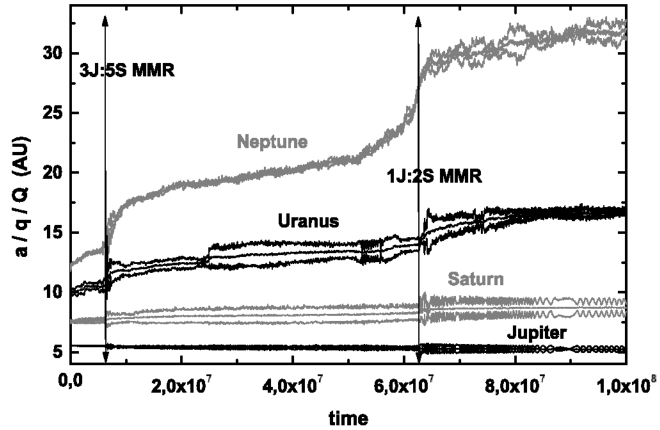
t=885 Myr
40
20
0
-20
-40
(AU)
-40
-20
0
20
40
(AU)

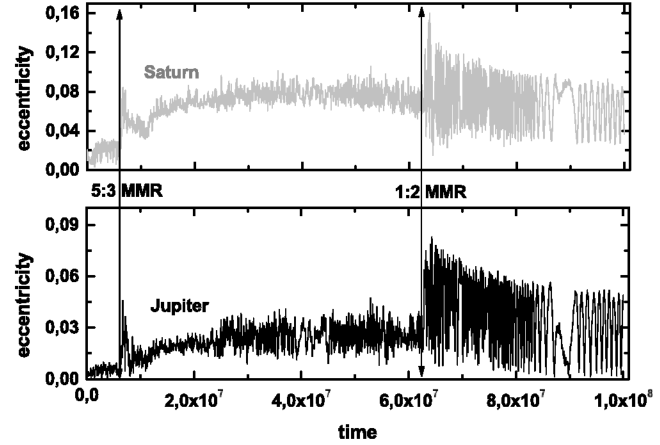


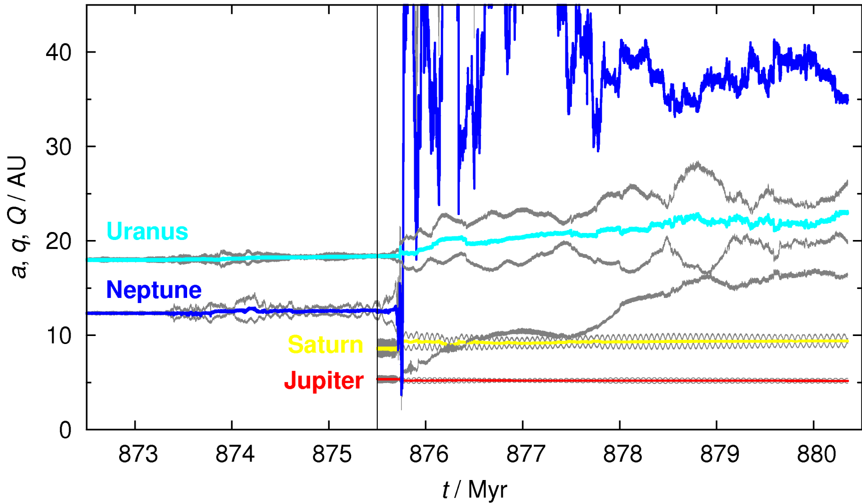
t=1213 Myr
40
20
0
-20
-40
(AU)
-40
-20
0
20
40
(AU)



HED meteorites
H-chondrite meteorites
Apollo 16
Lunar meteorites
100
0
30
0
200
0
50
0
2.5
3.0
3.5
4.0
4.5
Sum probability
Main belt asteroids
Moon
$^{40}Ar-^{39}Ar$ age (Gyr ago)


3J:5S MMR
1J:2S MMR
Neptune
Uranus
Saturn
Jupiter
a / q / Q (AU)
time


Saturn
eccentricity
5:3 MMR
1:2 MMR
Jupiter
eccentricity
time



Uranus
Neptune
Saturn
Jupiter
a, q, Q / AU
t / Myr
0
10
20
30
40
873
874
875
876
877
878
879
880

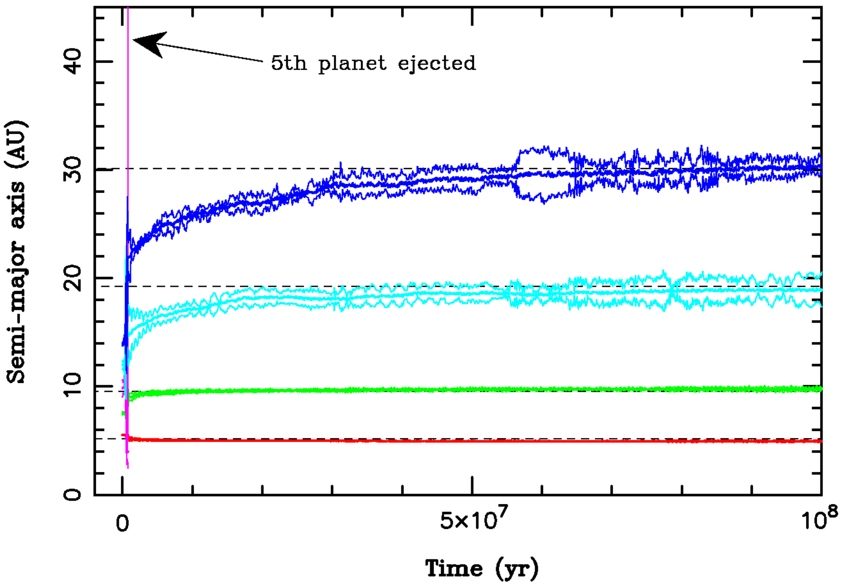
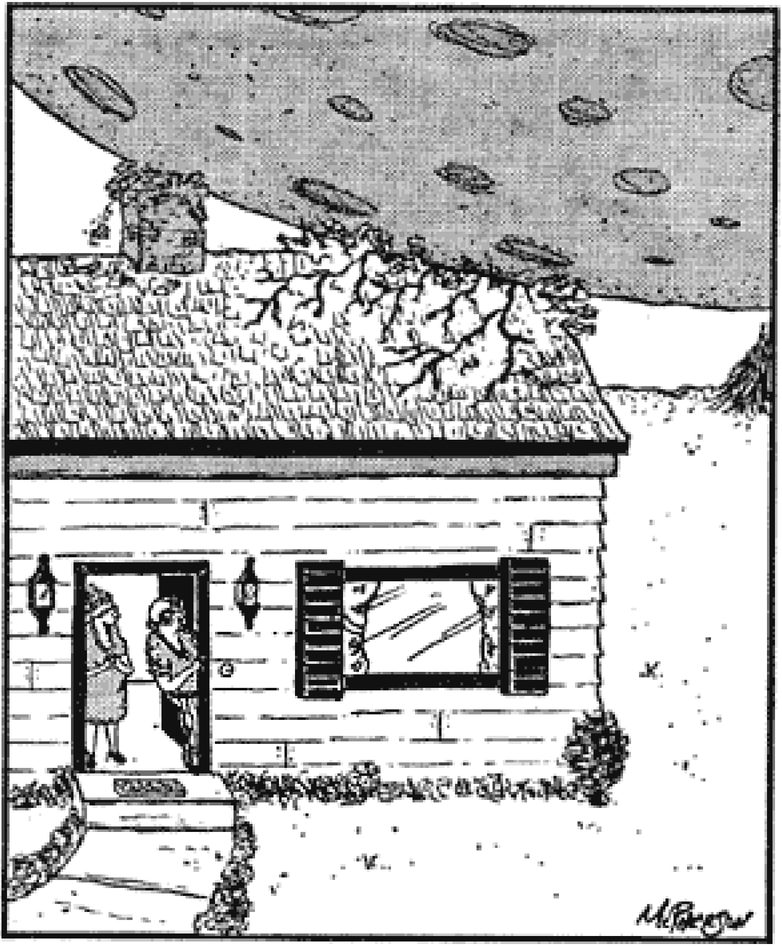


Figure 2. Orbit histories of giant planets in a simulation with five initial planets. The five planets were started in the (3:2,3:2,4:3,5:4) resonances, $M_{\rm disk} = 50\,M_{\rm Earth}$, and $r_{\rm in} = 15$ AU. After a series of encounters with Jupiter the inner ice giant was ejected from the solar system at 8.2×10^5 yr (purple path). The remaining planets were stabilized by the planetesimal disk and migrated to orbits that very closely match those of the outer planets (dashed lines).



"They say this is the closest Mars has been to Earth in 60,000 years."