



水星ナトリウム大気光観測

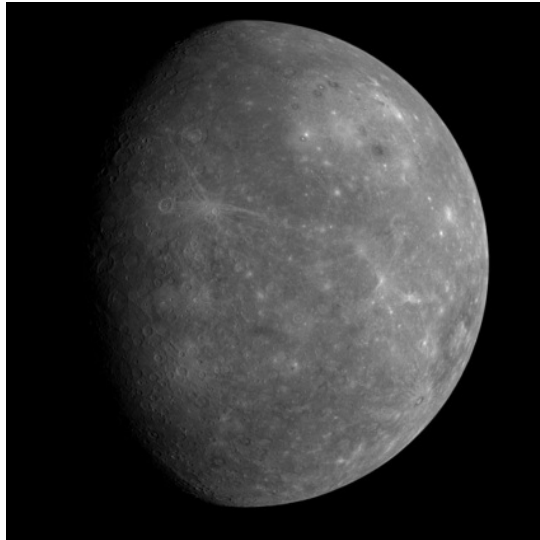
亀田真吾¹、鍵谷将人²、岡野章一²、
大六隼人¹、布施川綾花¹
¹立教大学, ²東北大学

Mercury

--Just 3 Flyby by Mariner 10 in 1973-1974.

No observation by any orbiter
until March 18, 2011 (MESSENGER)

--Like Moon?

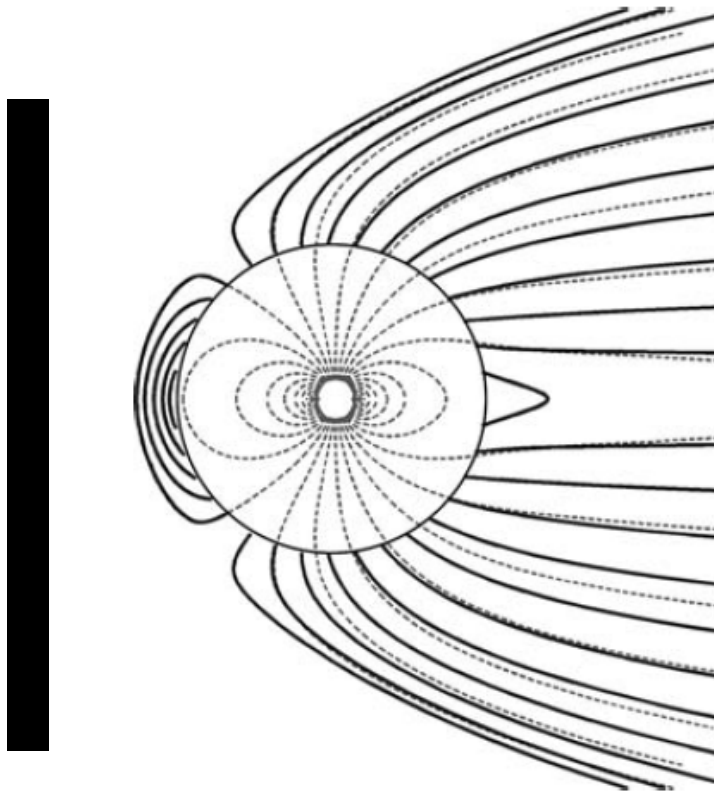


Mercury

--Like Moon? → Several differences.

1, Intrinsic magnetic field

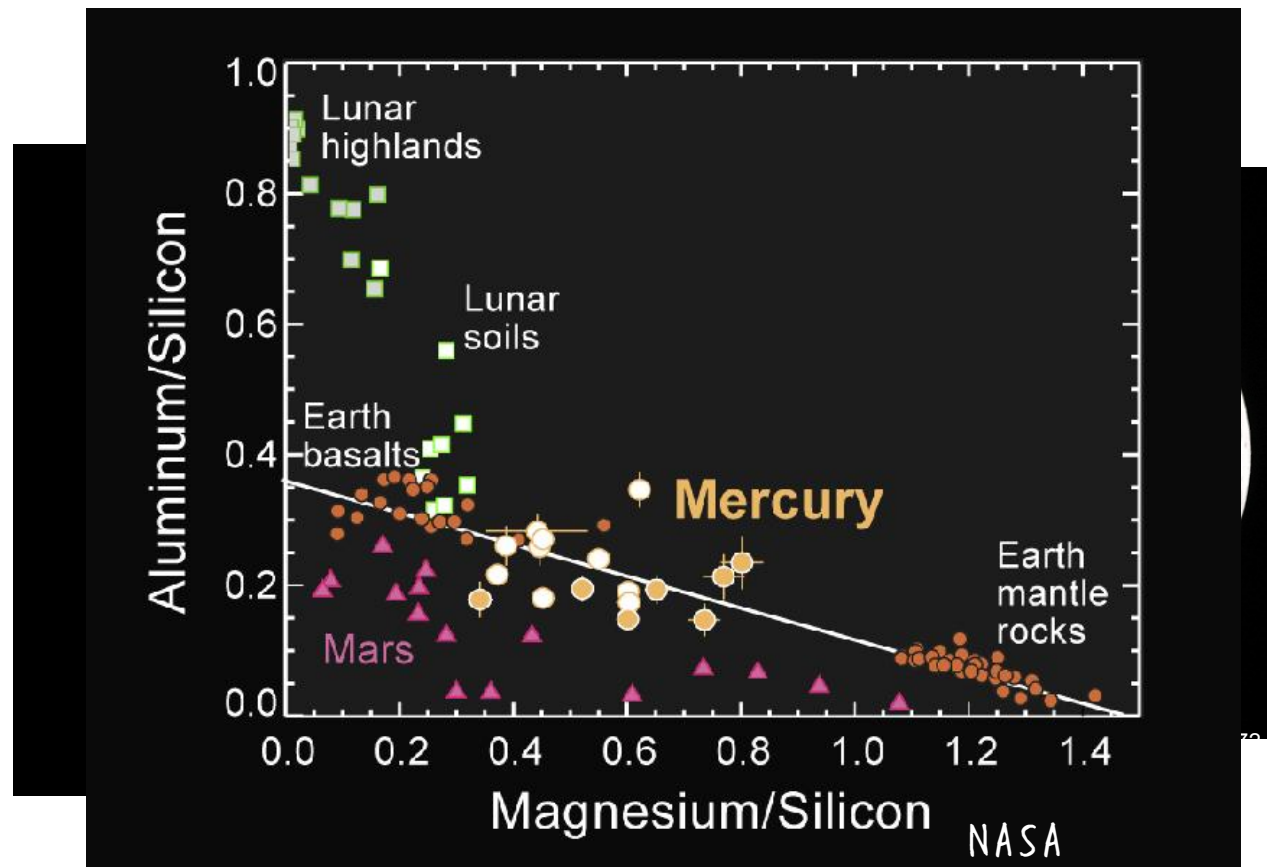
Found in 1973 and its origin is still under discussion.



Mercury

--Like Moon? → Several differences.

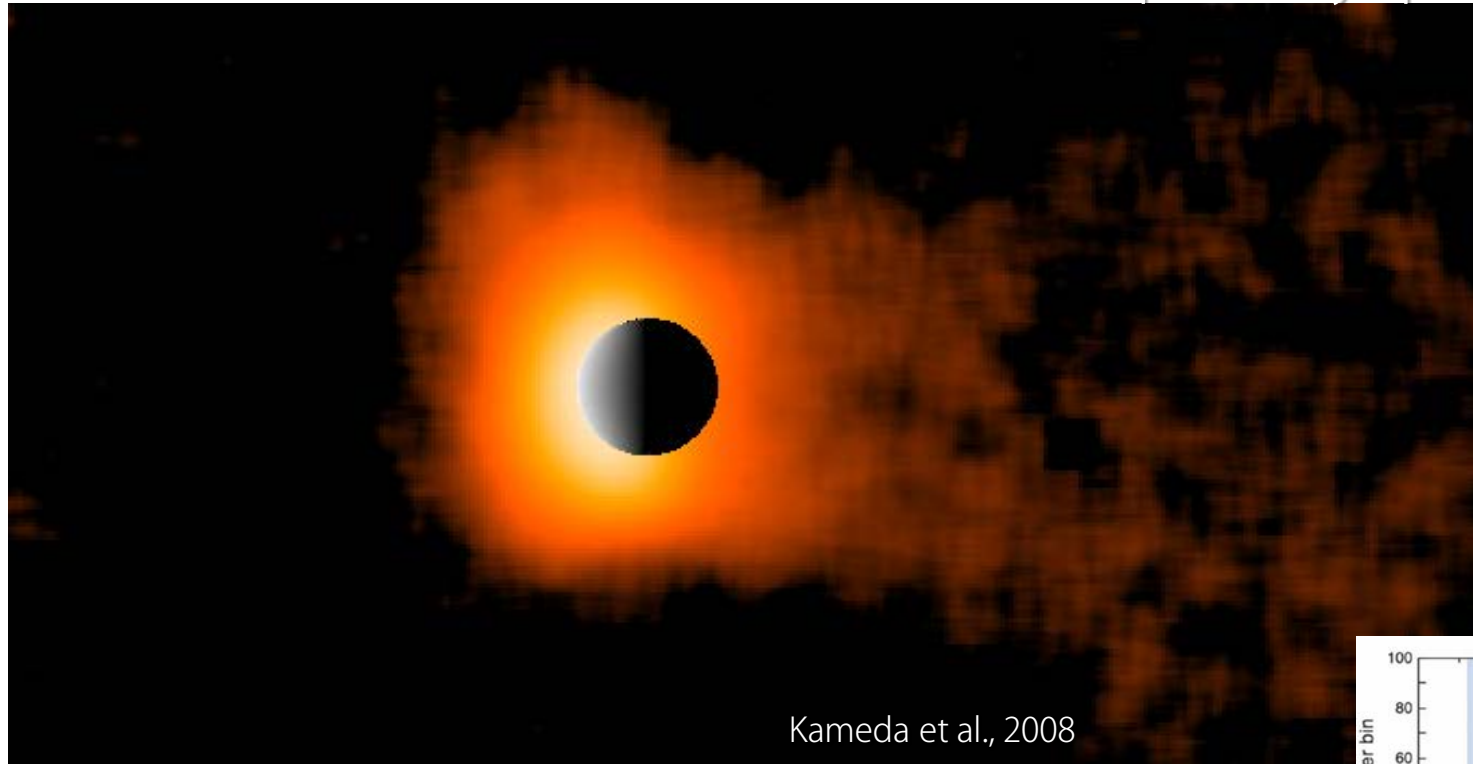
2, Composition (Observed by MESSENGER)



Mercury's atmosphere

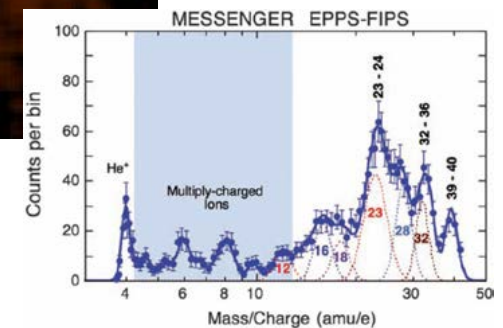
Collisionless atmosphere $P \sim 10^{-12}$ atm

Released from the surface → Impact to the surface (SP, SW, IPD)
→ Loss to the Interplanetary Space



Remote Sensing: H, He, O, **Na**, K, Ca, Mg, Ca⁺, Al?, Fe?

In Situ : H⁺, He⁺, **Na⁺** (Mg⁺), O₂⁺, K⁺ (Ca⁺, Ar⁺), etc.

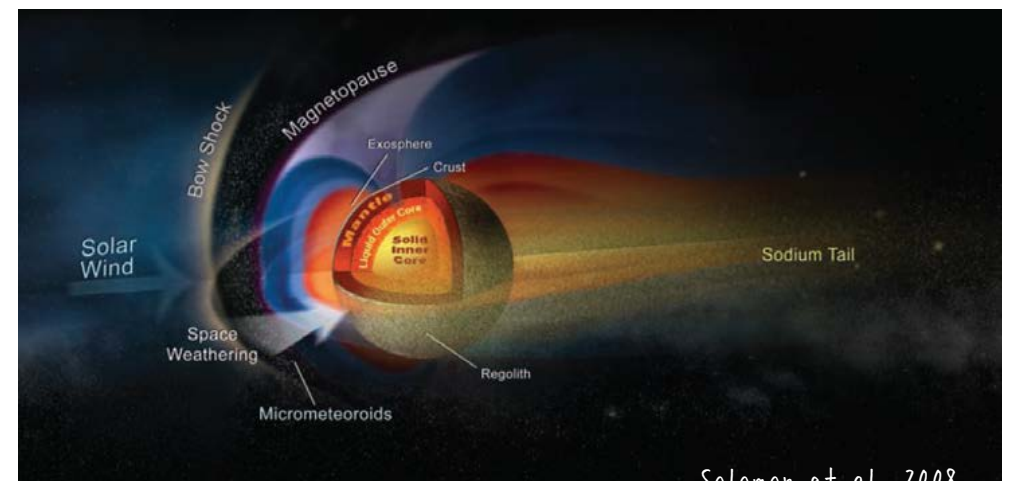


Zurbuchen et al., 2008

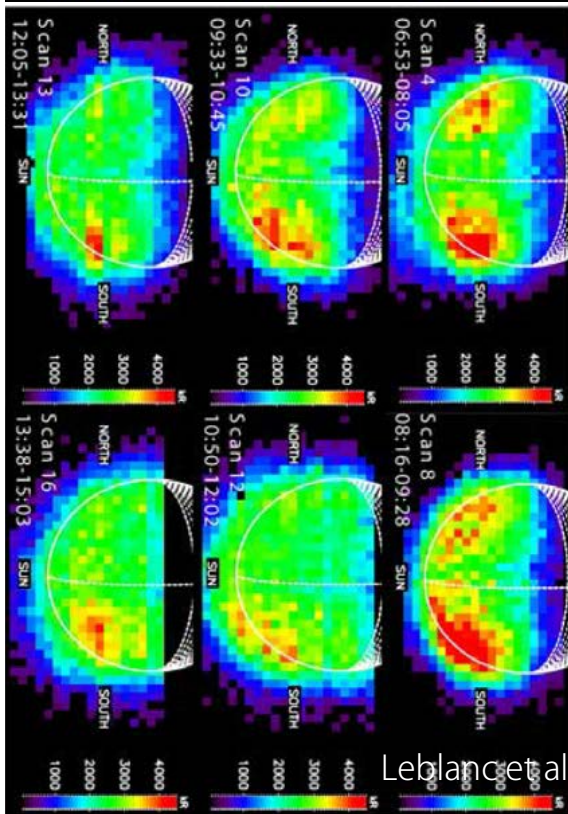
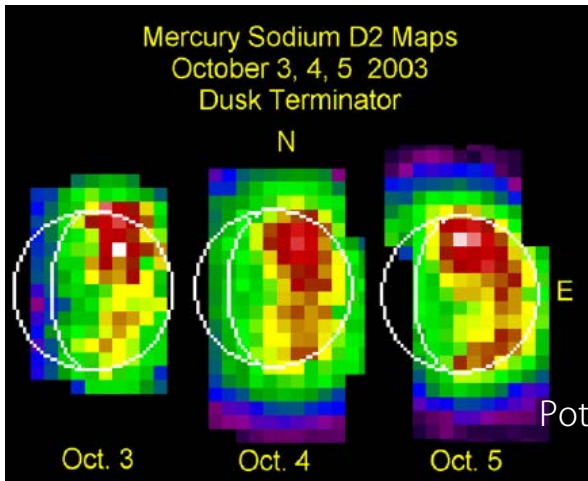
Mercury's Atmosphere

- Interaction between the solid surface and Mercury's environment

diffusion

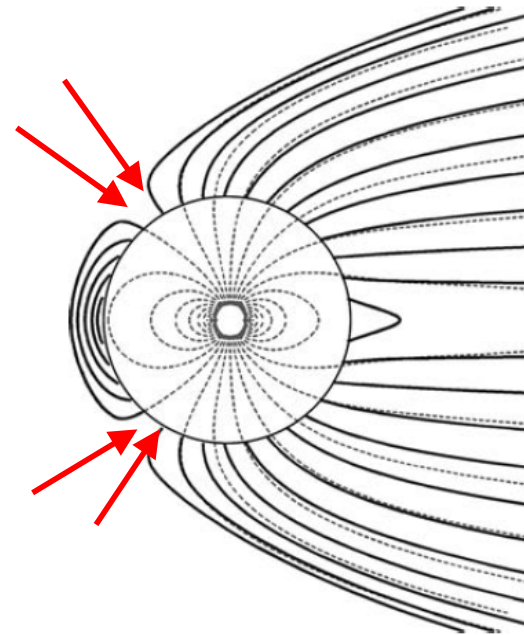


Source process of Mercury's exosphere?

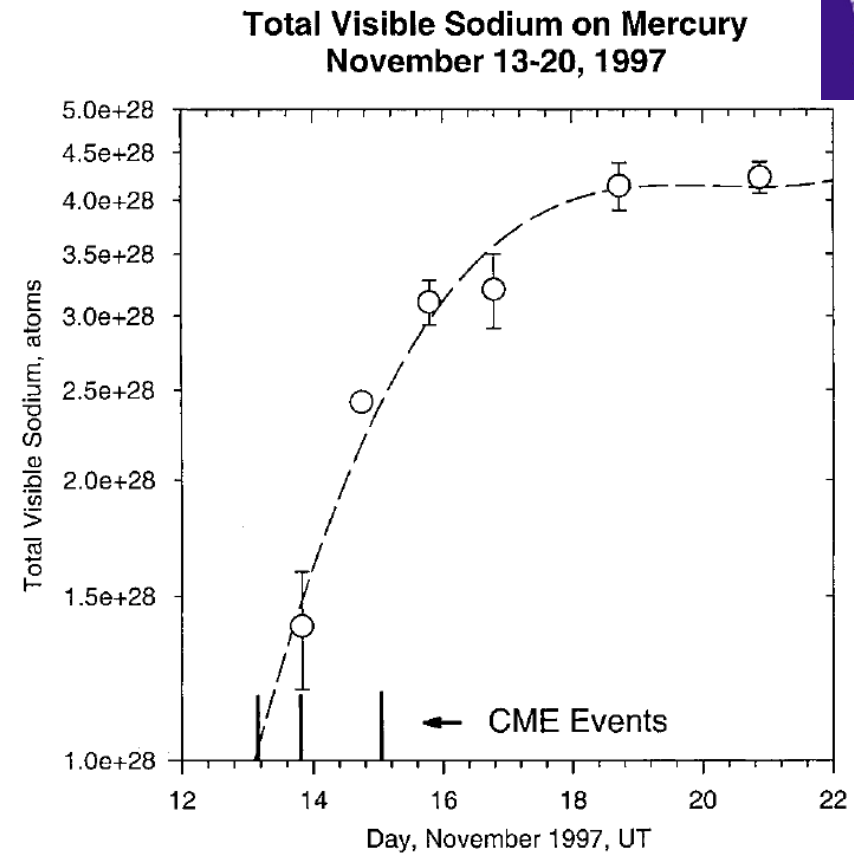
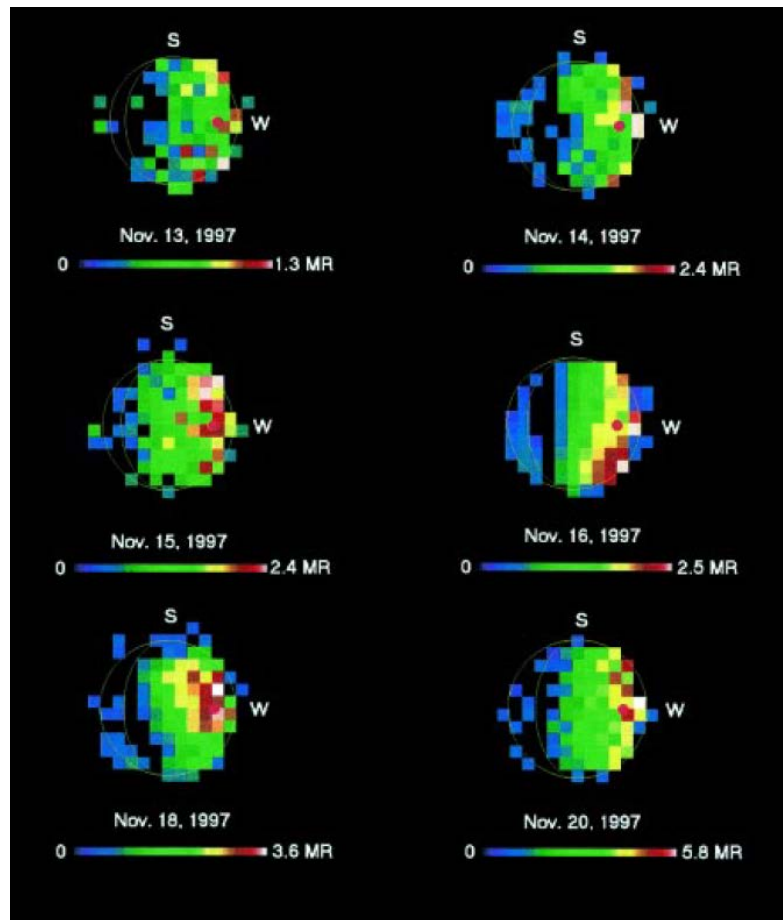


Leblanc et al

→ Effect of Solar wind impact??



Rapid change observed in the past



Potter et al., 1999 explained that the increase was possibly caused by CME. (and no other candidate)

2011年の観測

- ・ マウイ・ハレアカラ
観測所
- ・ 2010年よりリモート
観測可能
- ・ 2011年夏から伸縮式
遮光フードを設置し
、日中の観測
- ・ 岡山では、、、





Apr. 11	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. 12	Feb.	Mar.
1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3
4	4	★	4	4	4	★	4	4	4	4	4
5	5	★	5	5	5	5	★	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	★
8	8	8	8	8	8	8	8	8	8	8	8
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11	11	11	11	11	11	11	★	11	11	11	★
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29	29	29	29	29	29	29	29	29	29	29	29
30	30	30	30	30	30	30	30	30	30	30	30
	31		31	31		31		31	31		31





Normalized Intensity

17:52(UT)
Jan. 2

18:12(UT)
Jan. 5

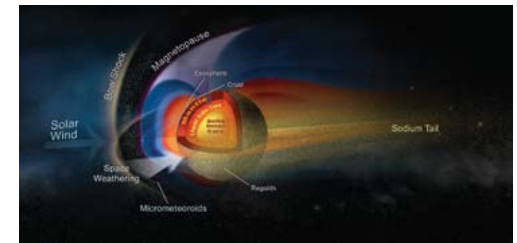
hour

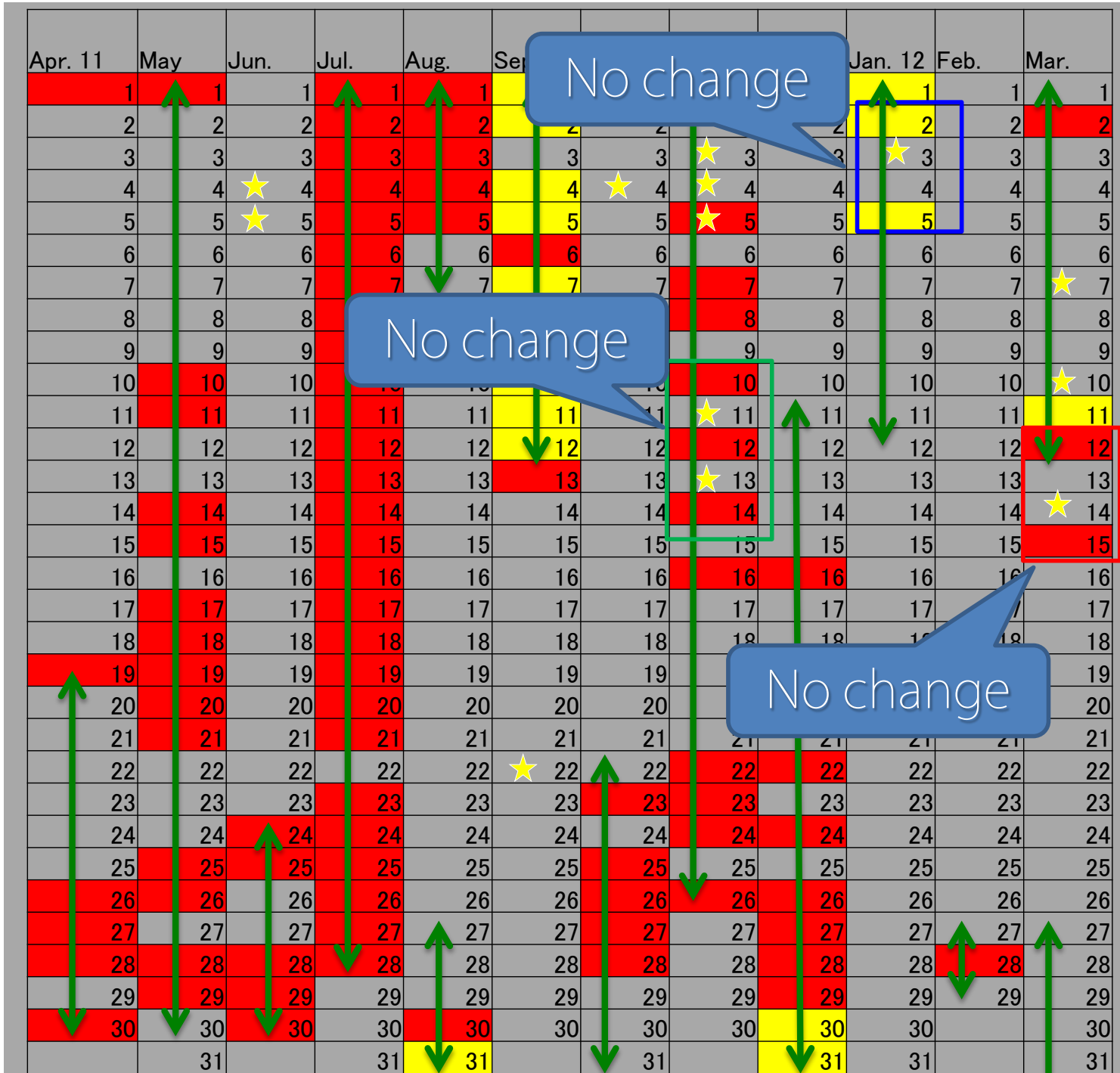
	Jan. 2	Jan. 5
γ	0.37116	0.30123

CME EVENTS AT MERCURY MESSENGER



- March 12
- March 15



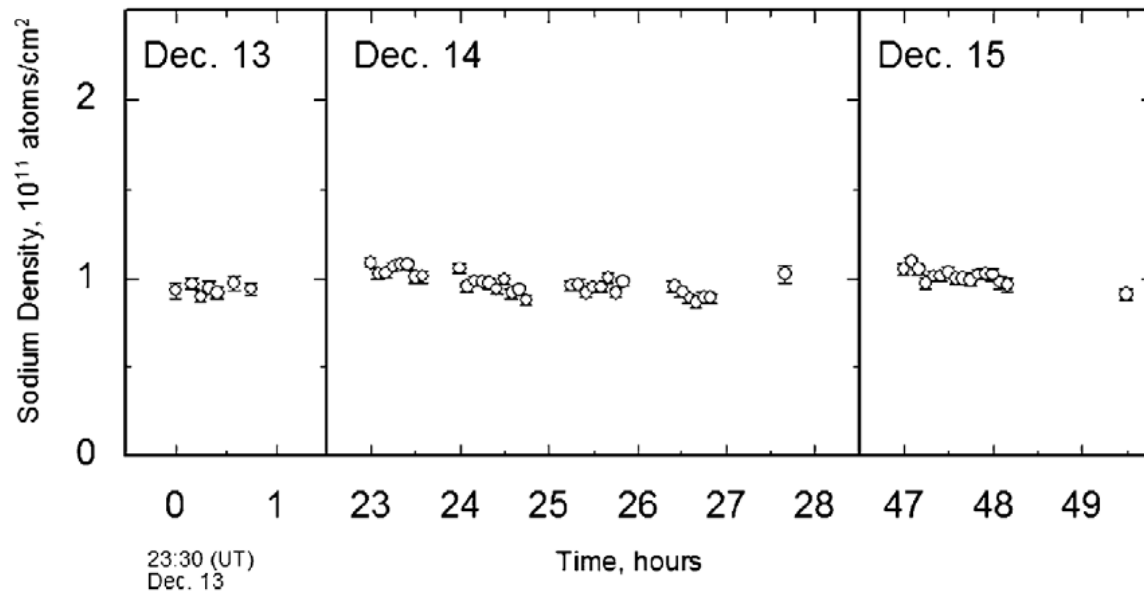


↕ when elongation is grater than 15°

■ Before sunrise or After sunset
 ■ daytime

★=CME EVENTS AT MERCURY MESSENGER

Temporal variability of average density

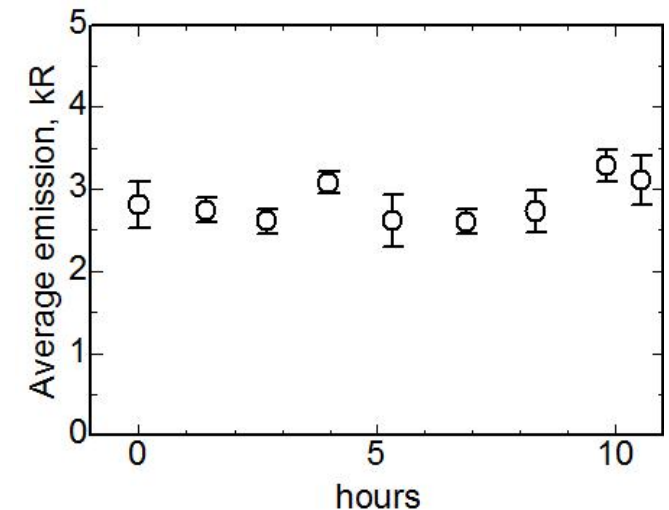


Karneda et al., 2007

Dec 2005 & Aug 2008 (OAO in Japan)

Temporal variability of
Average density $< \sim 10\%$

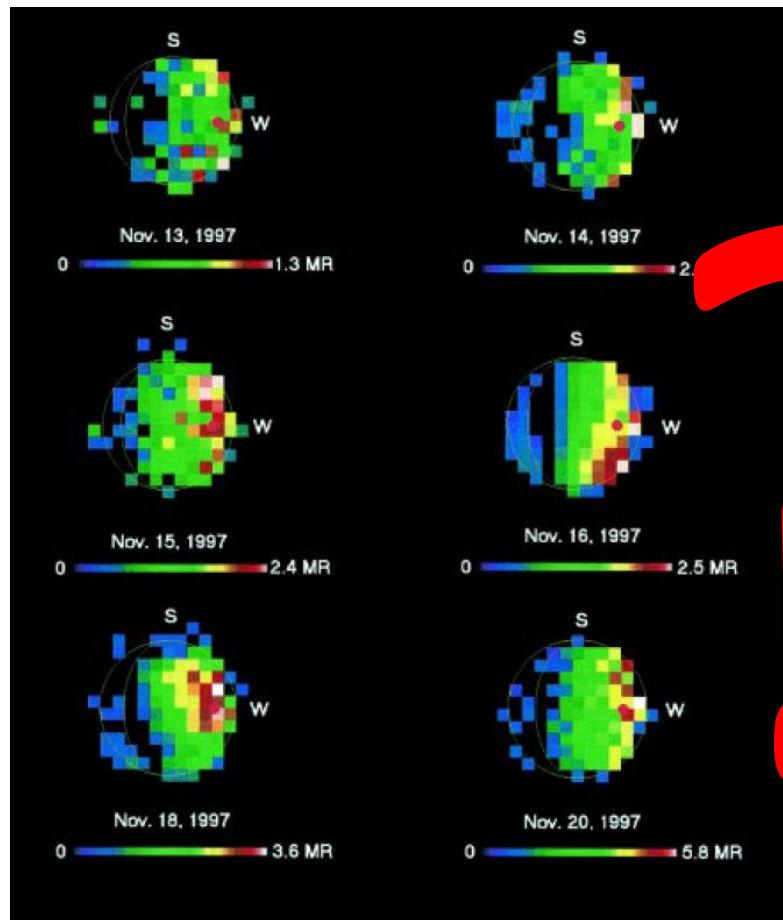
→ SW variability should be
higher... >> ???



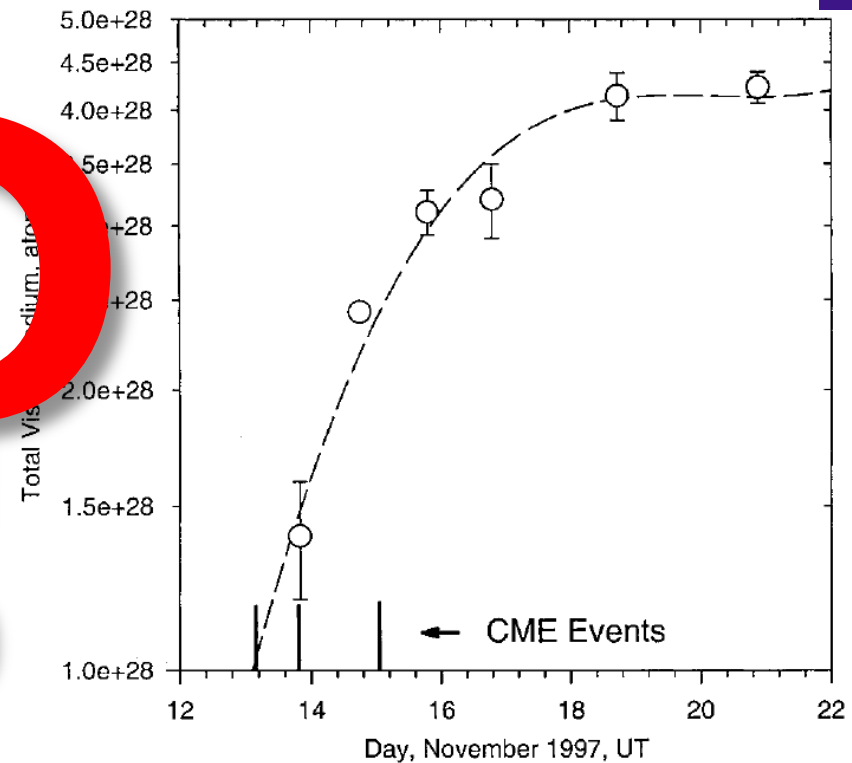
25 Aug 2008

$1\sigma \sim 9\%$ [Leblanc et al. 2009]

Rapid change in the past?

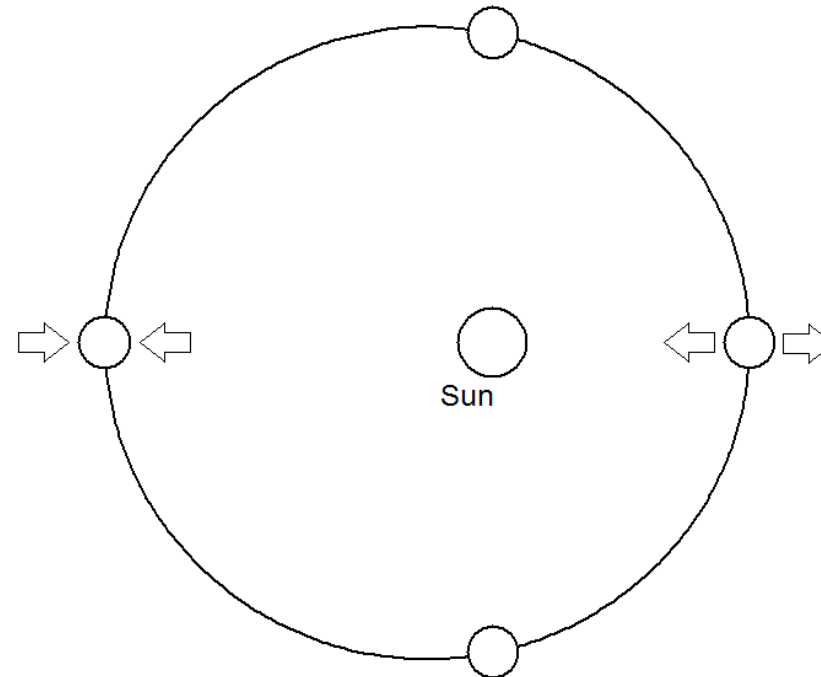


Total Visible Sodium on Mercury
November 13-20, 1997



Potter et al., 1999 explained that the increase was possibly caused by CME. (and no other candidate)

6. Solar tides



Tidal force is always outward.

→ Relative tidal force is inward at aphelion and outward at perihelion.

→ Distortion is greatest at perihelion and aphelion.

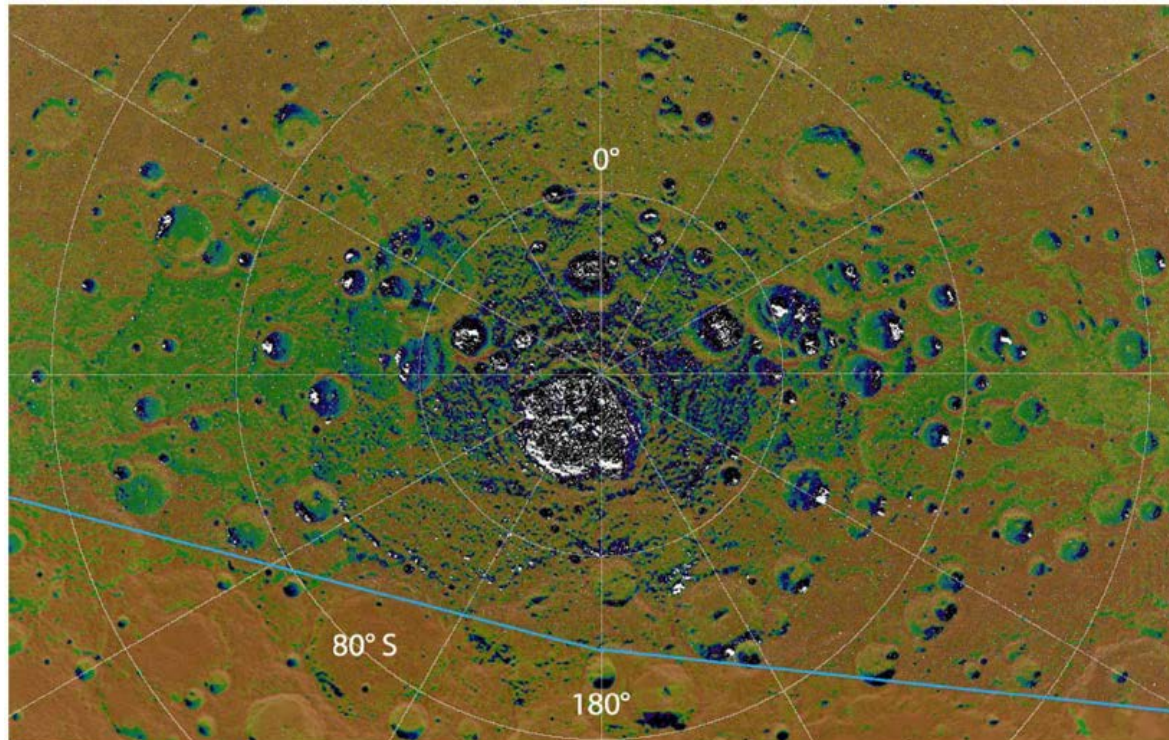
6. Solar tides



Tidal force is not a
release process,
however,,,
Tidal force will
possibly increase
the source rate,
e.g., refreshing
the surface layer.



高緯度の濃集→永久影



Chabot et al., 2012

- 高緯度域には日照がほとんどない地域が多い。吸着した揮発性物質が地震その他により放出される(ということも考えられる?)



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