



Pengamatan Virtual Langit Malam Observatorium Bosscha

Seri XII: Observasi Planet

Evan I. Akbar

KK Astronomi - fisika bintang
& Observatorium Bosscha

Dari Masa ke Masa

24 Okt 2020



Pengembara yang bergerak diantara bintang-bintang

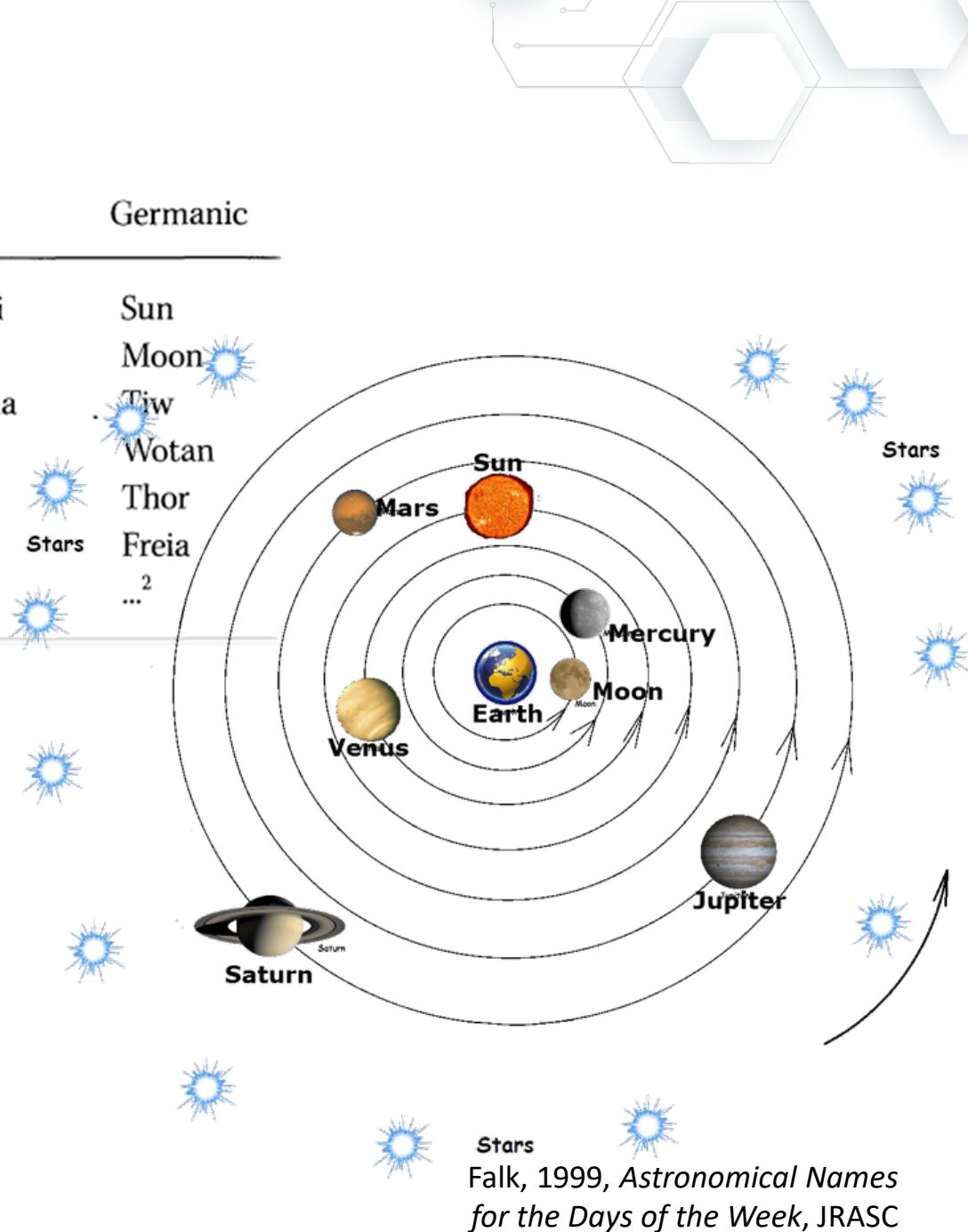


Planet yang dikenal dari jaman dahulu

	Babylonian ¹	Latin	Greek	Sanskrit	Germanic
Sun	Shamash	Sol	Helios	Surya, Aditya, Ravi	Sun
Moon	Sin	Luna	Selene	Chandra, Soma	Moon
Mars	Nergal	Mars	Ares	Angaraka, Mangala	Tiw
Mercury	Nabu	Mercurius	Hermes	Budh	Wotan
Jupiter	Marduk	Iupiter	Zeus	Brihaspati, Cura	Thor
Venus	Ishtar	Venus	Aphrodite	Shukra	Freia
Saturn	Ninurta	Saturnus	Kronos	Shani	...

TABLE I
Babylonian Lunar Month

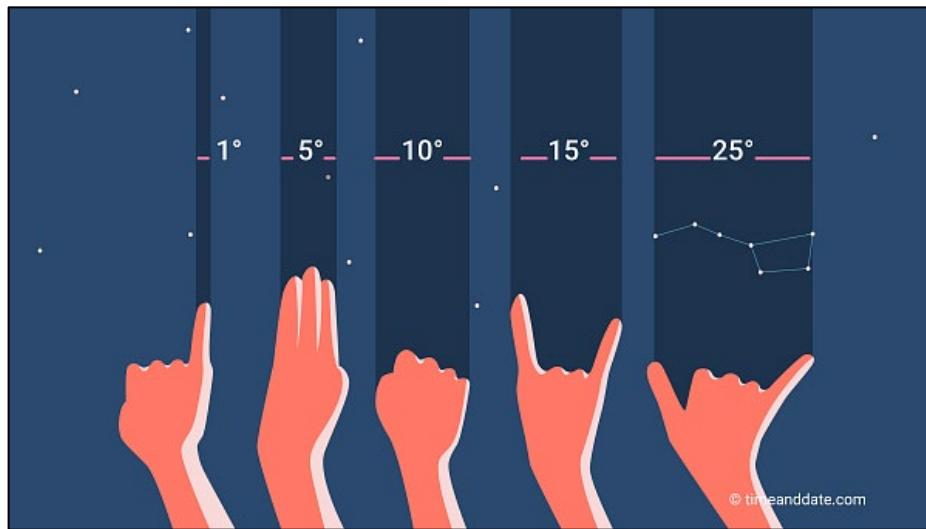
1	2	3	4	5	6	7	●	First Quarter
8	9	10	11	12	13	14	○	Full Moon
15	16	17	18	19	20	21	◐	Last Quarter
22	23	24	25	26	27	28	●	New Moon
29	(30)							



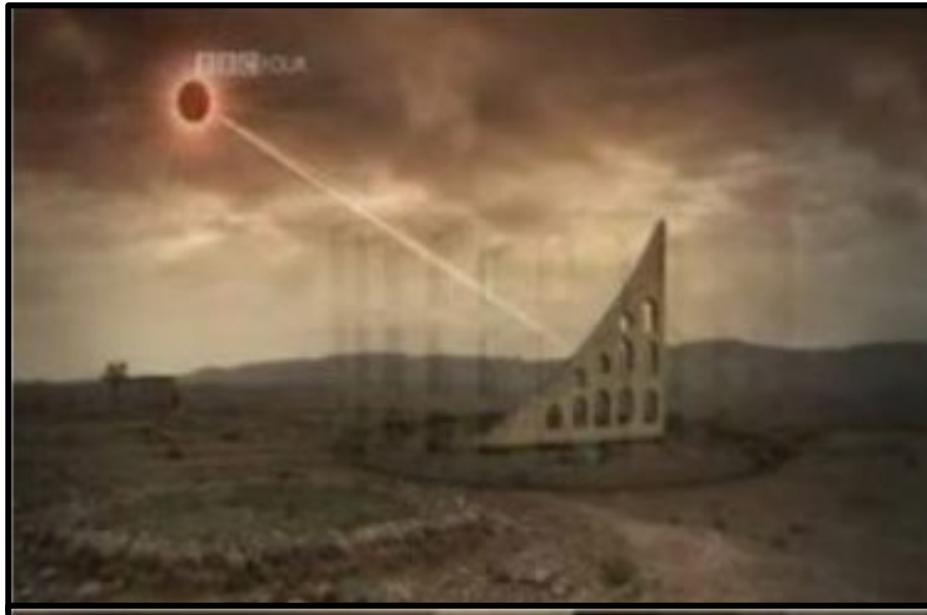
Mengukur posisi planet dan bintang



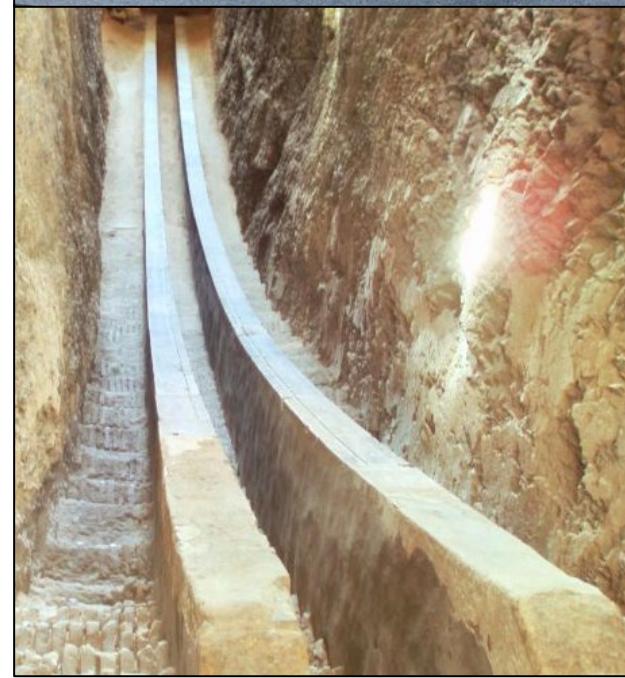
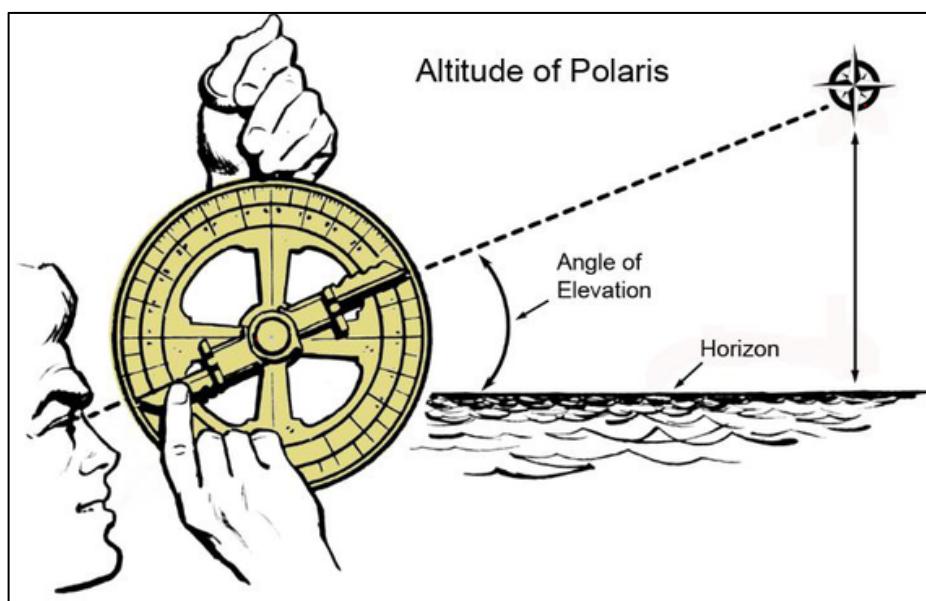
Peralatan sederhana



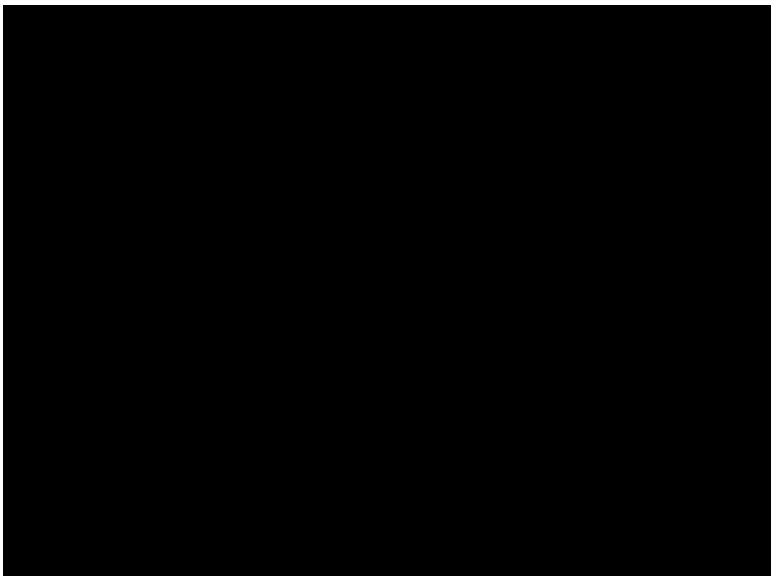
Observatorium Maragheh, 1259 (BBC Four)



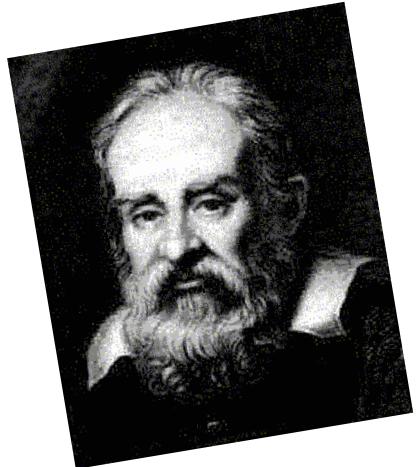
Observatorium Ulugh Beg, 1420



Hans Lipperhey: Pemegang hak paten 'looker' (1608)



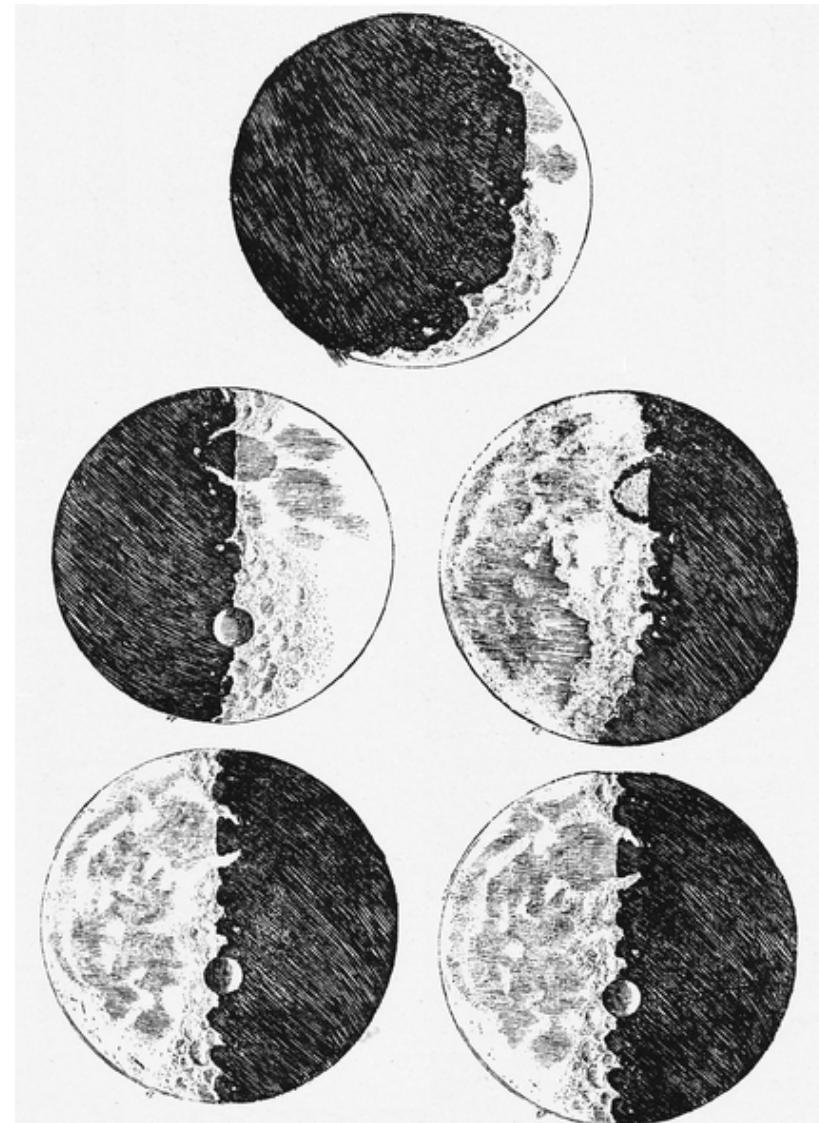
Galileo Galilei: teleskop (1609)



Teleskop Galileo (2,6 cm, f=133 cm)



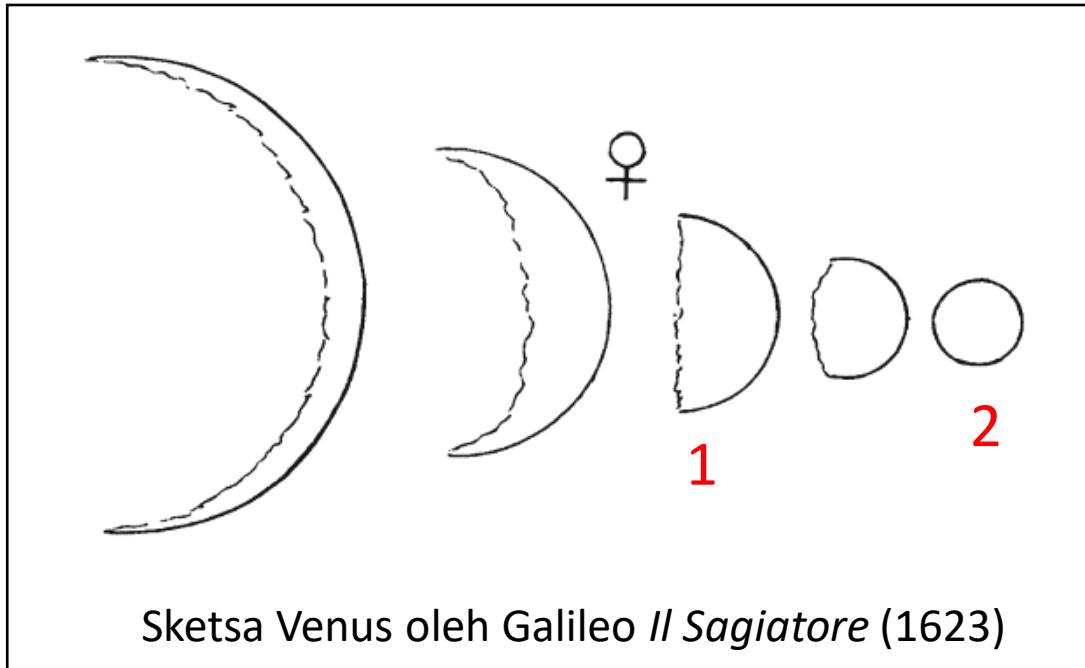
Sketsa Bulan (30 Nov 1609)



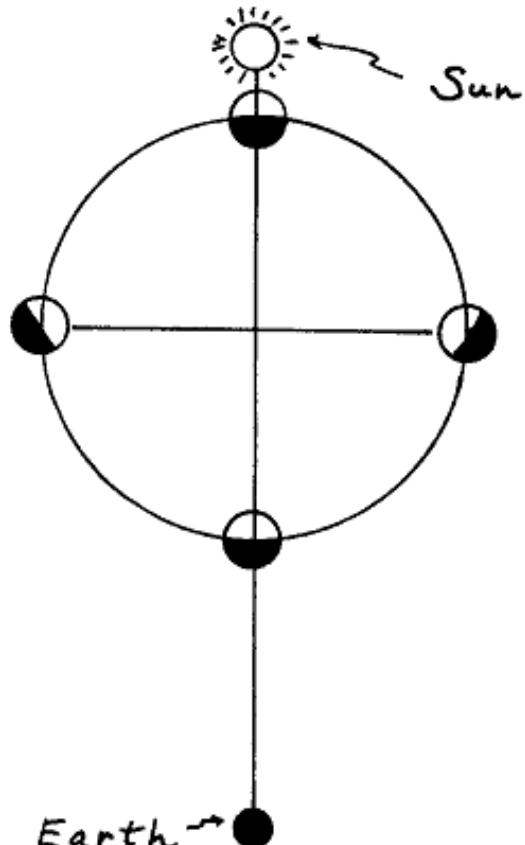




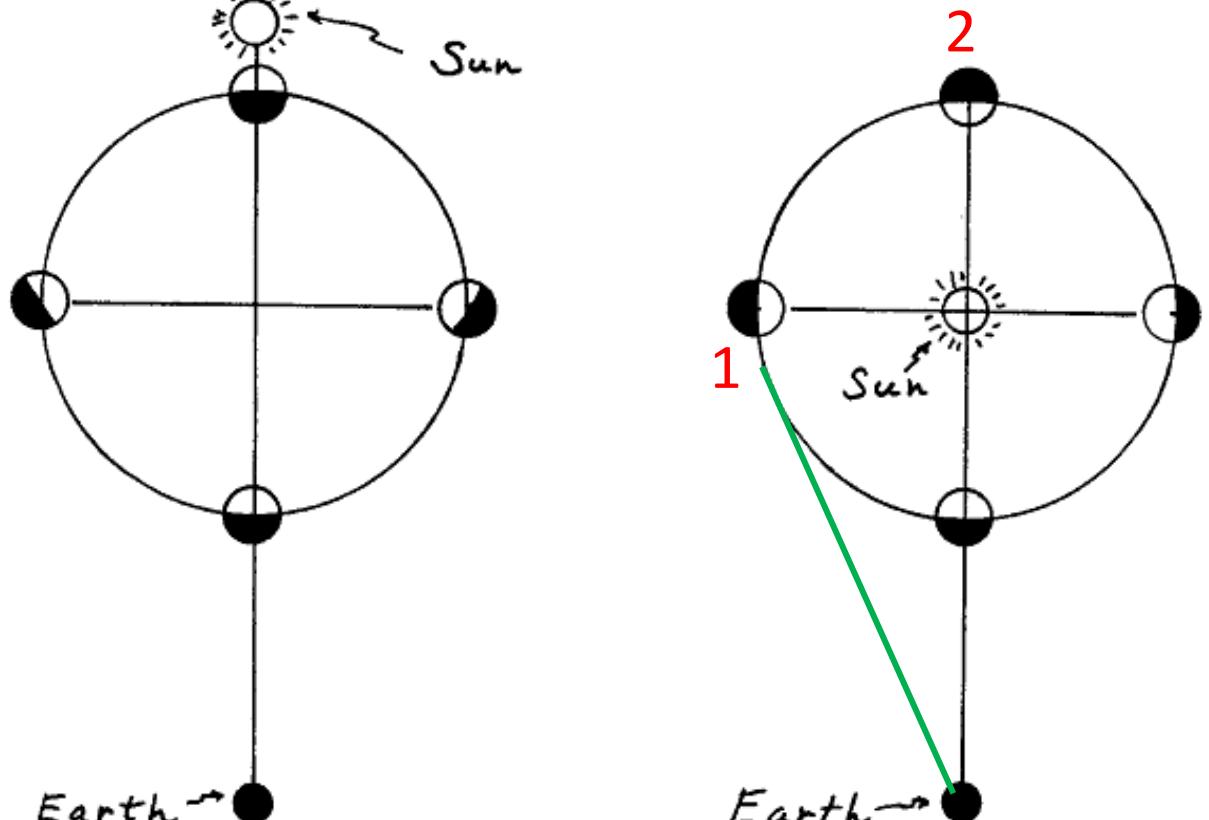
Pengamatan Planet: Venus



Venus mengalami perubahan fase.



Geocentris

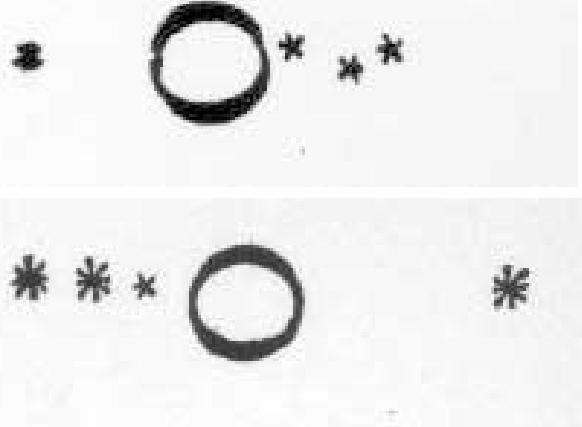


Heliosentris



Pengamatan Planet: Jupiter

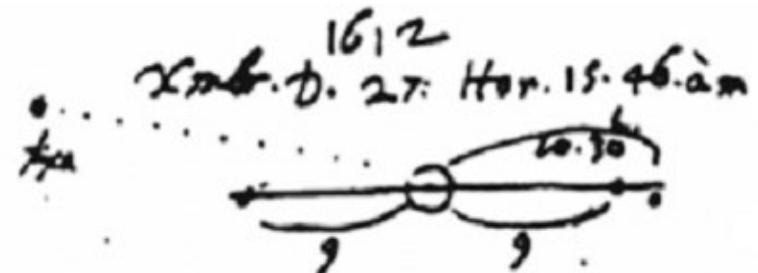
Sketsa Jupiter (1610)



Pengamatan modern

Observation Jupiter	
20. Febr.	○ * *
March 1	○ * *
30. March	* ○ *
1. April	○ * *
3. April	○ * *
3. Apr. 5	* ○ *
9. April	* ○ *
6. April	* ○ *
8. April H. 17	* * * ○
10. April	* * * ○ *
11.	* * * ○ *
12. Apr. 17	* ○ *
17. April	* * ○ *
18. April	* * * ○ *

Tidak semua benda langit berevolusi mengelilingi Bumi seperti yang orang Yunani perkirakan.



Neptune

Europa



Io
Ganymede

Jupiter

27 December 1612

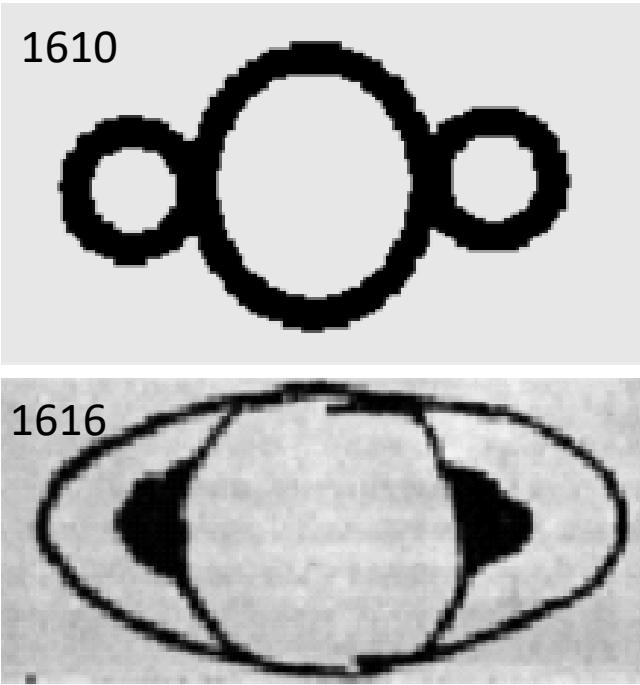
Pengamatan Planet: Saturnus



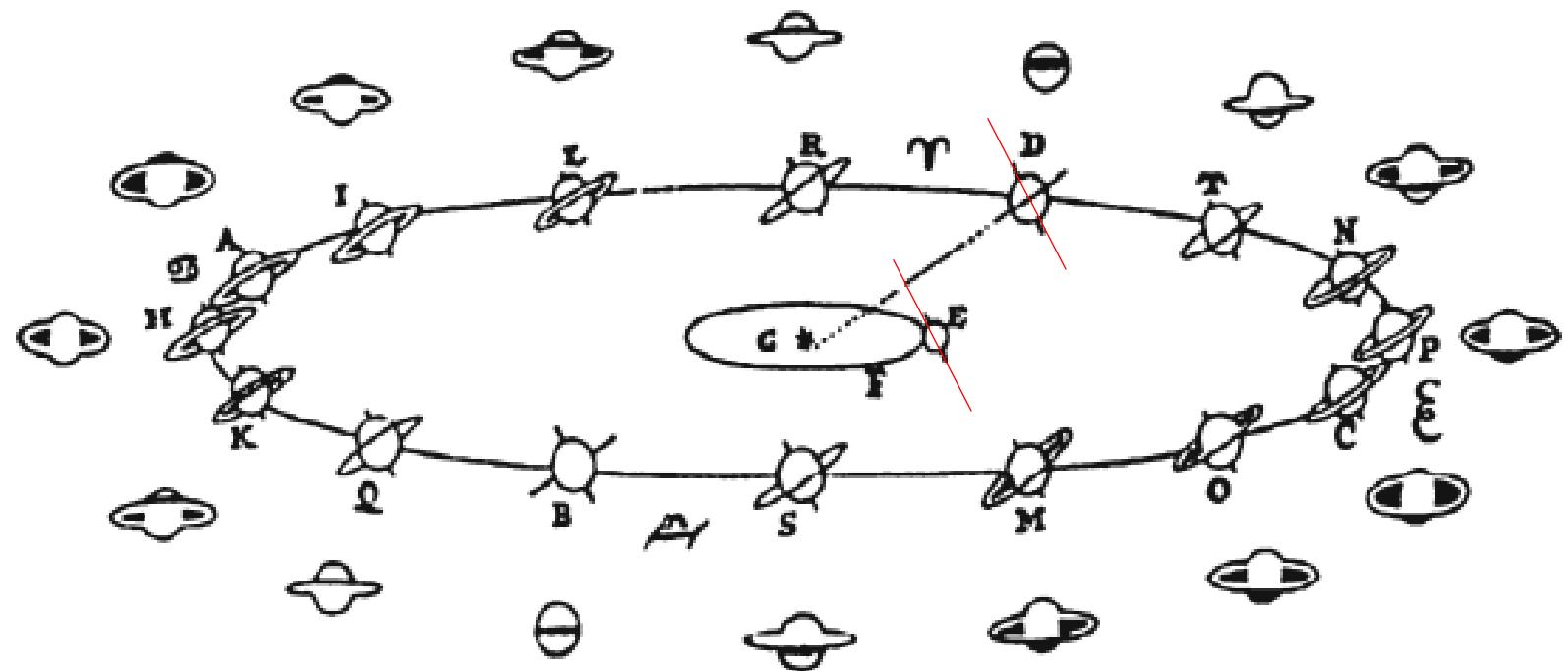
30 Juli 1610:

“... the star of Saturn is not a single star, but is a composite of three ... and they are situated in this form: oOo “

Christiaan Huygens
menggambarkan cincin Saturnus
(1659)



Sketsa Saturnus

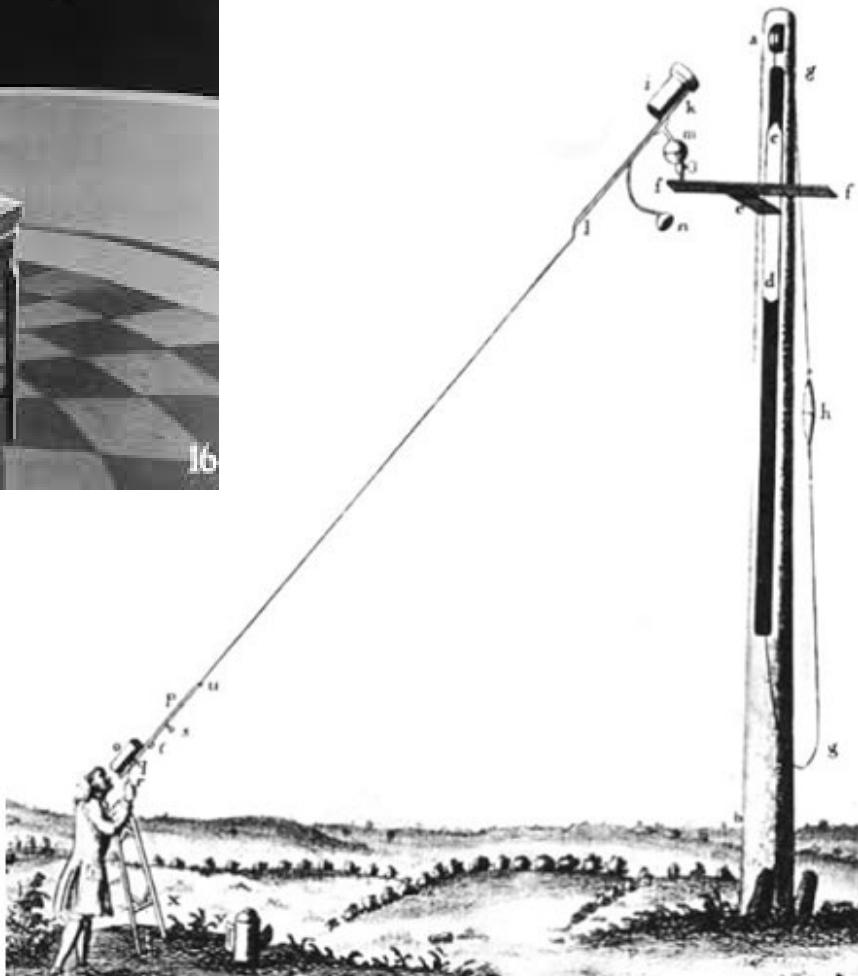


Huygens: *Systema Saturnium* (1659)

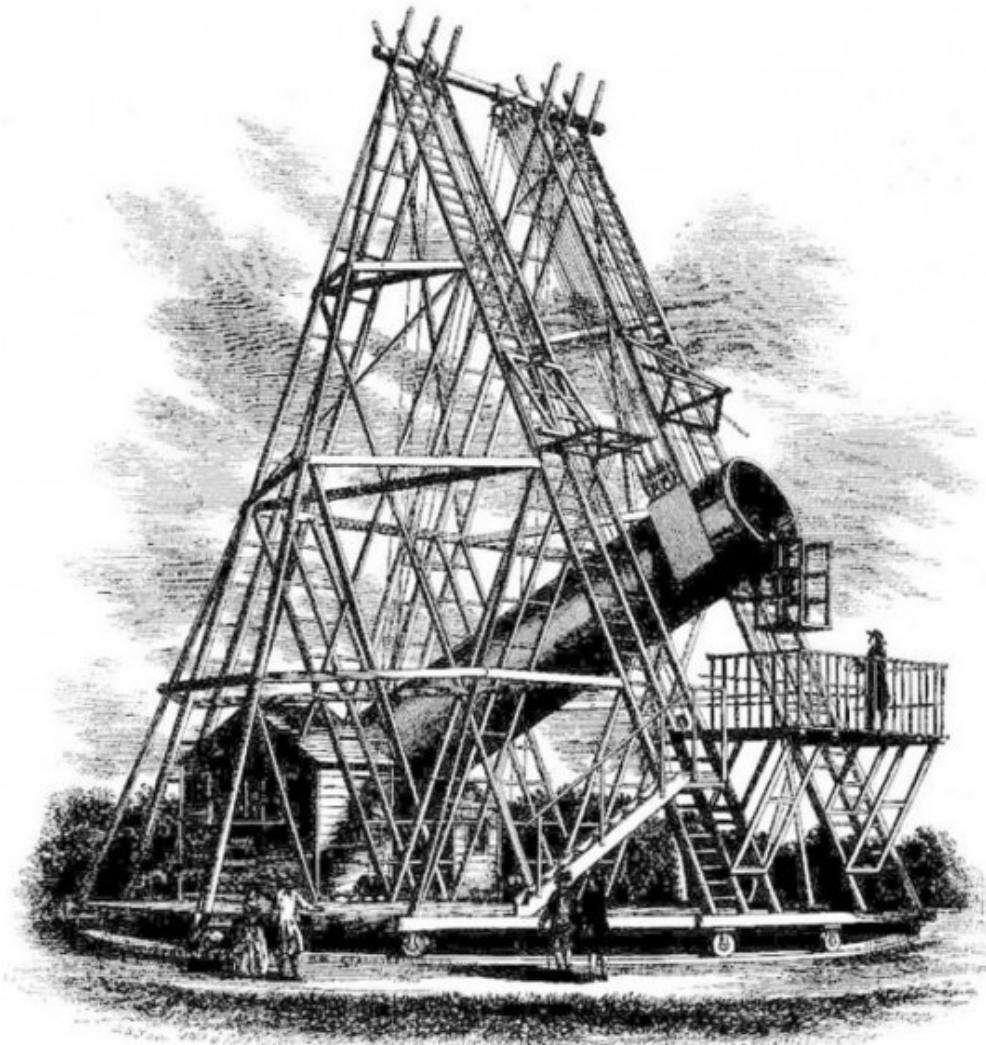
Perkembangan teleskop



Teleskop Galileo (1609)



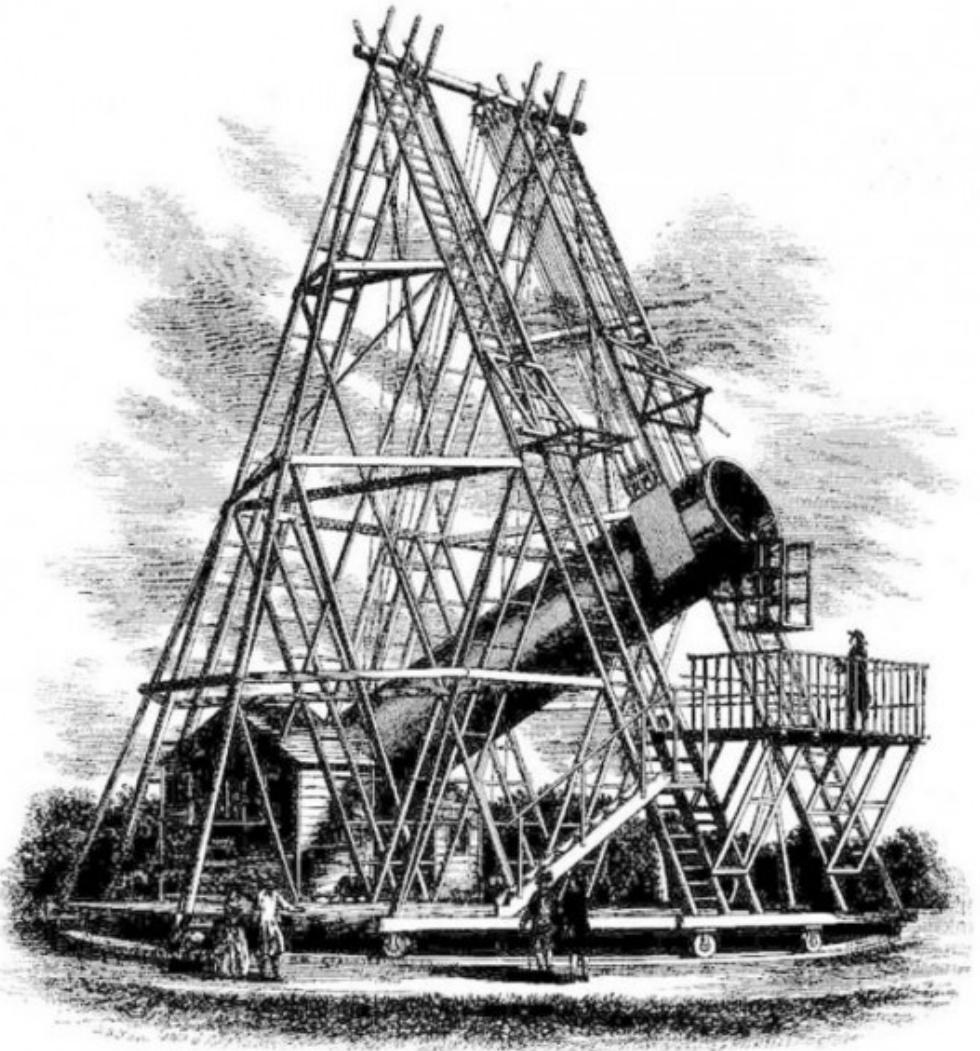
Teleskop Hyugens (1686)



Teleskop William Herschel (1789)



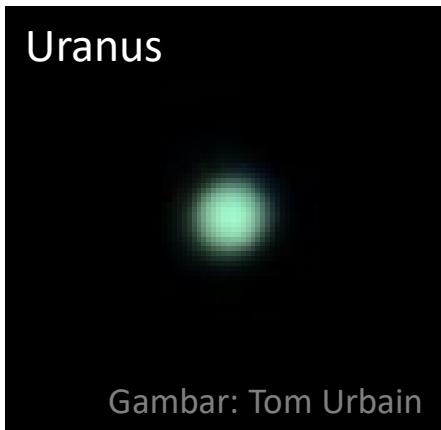
Penemuan planet: Uranus (1781)



William Herschel dan adiknya, Caroline



Uranus

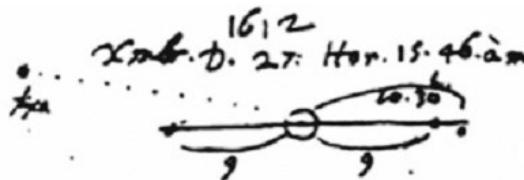


Gambar: Tom Urbain

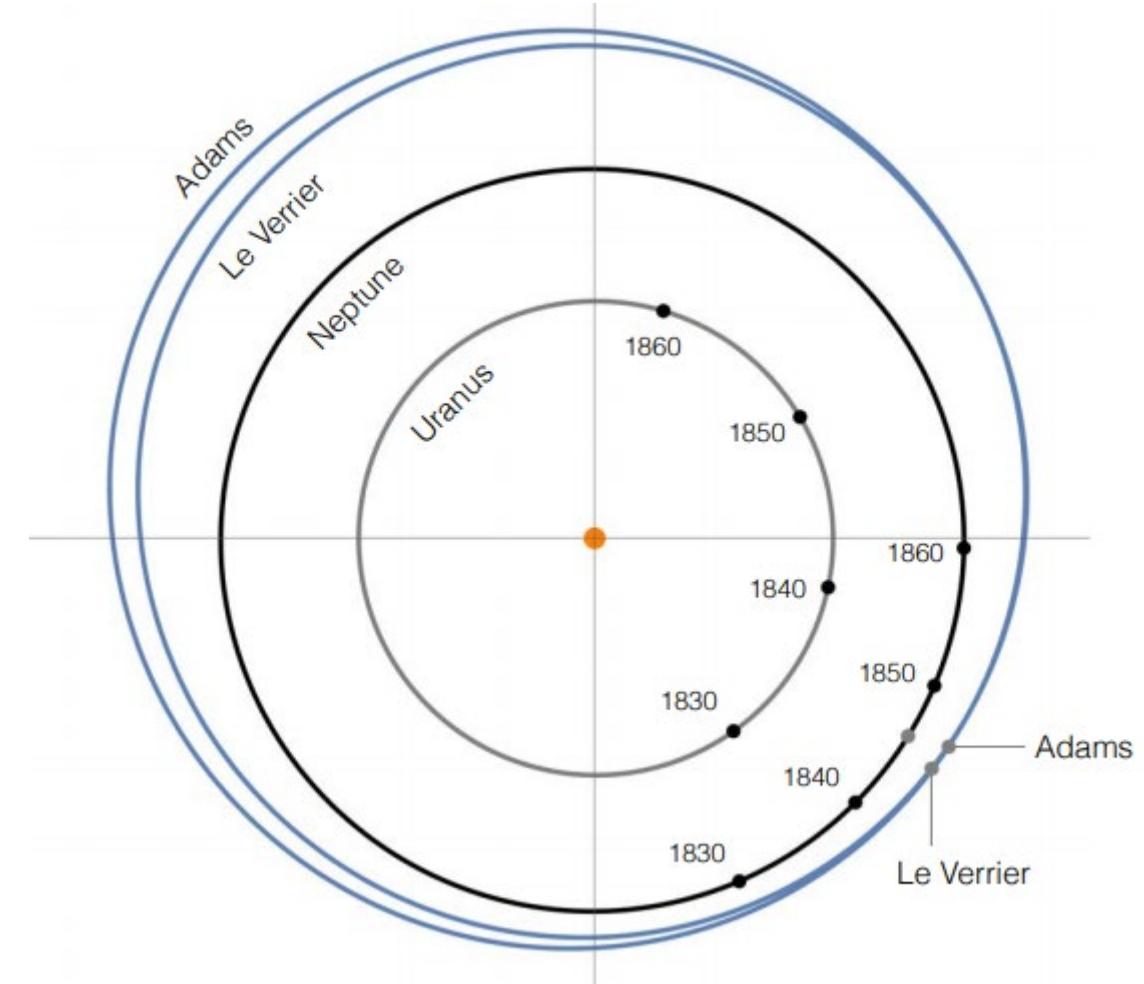
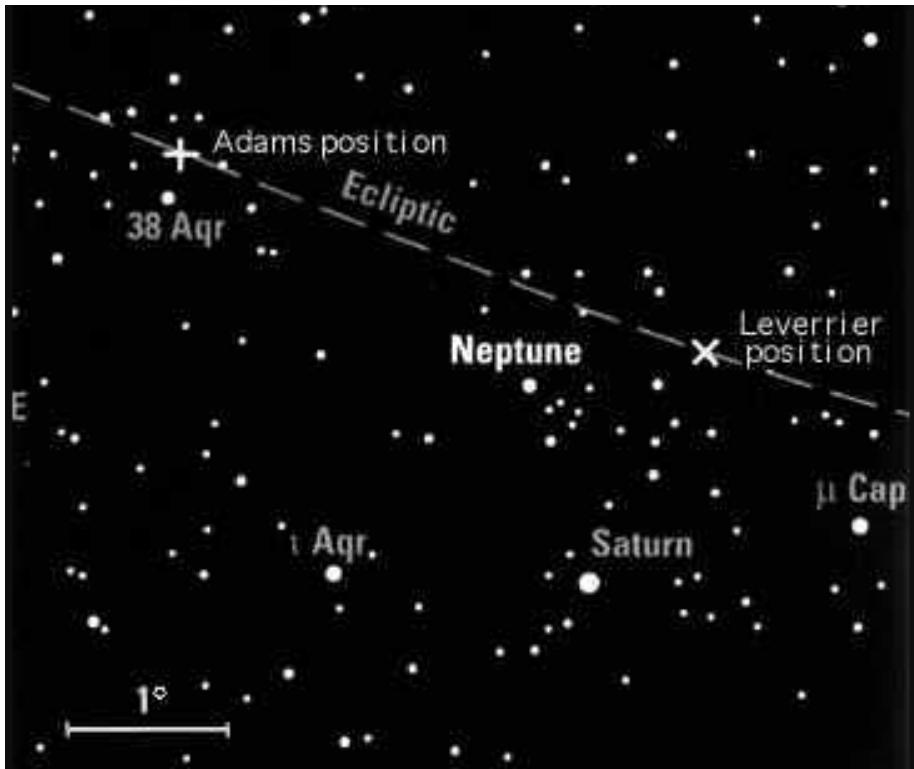
Penemuan planet: Neptunus (23 Sept 1846)



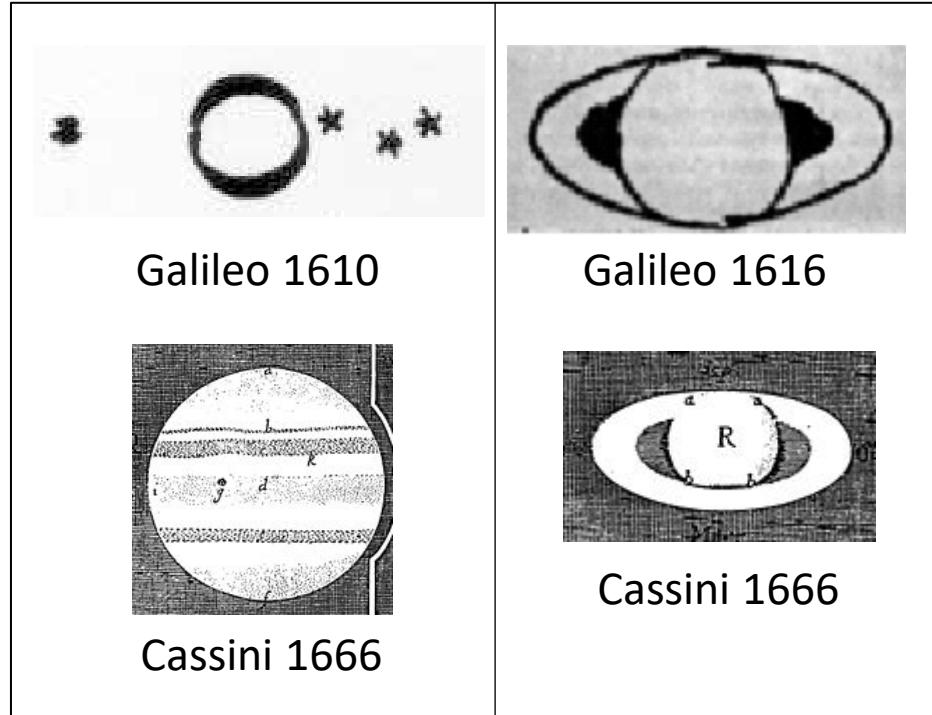
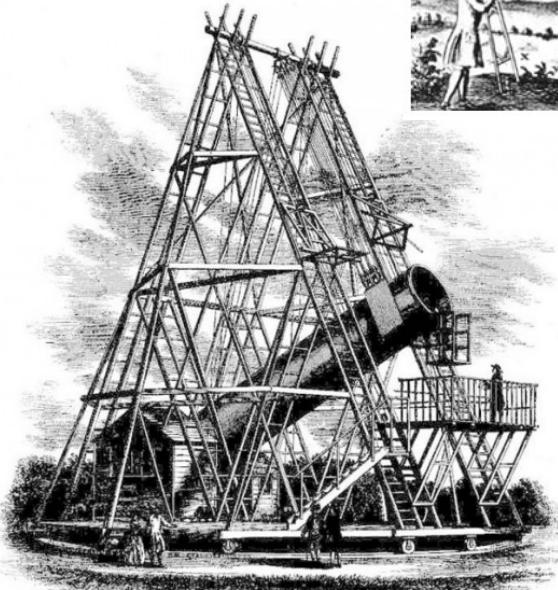
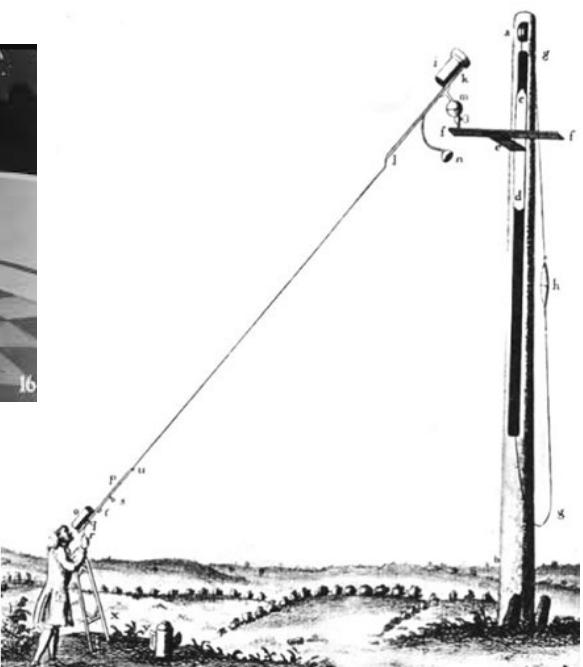
Pernah diamati Galileo, 1612-1613
(Standish & Nobili, 1997)



Penemuan secara matematis oleh
Urbain Jean-Joseph Le Verrier dan
John C Adams (observasi: Johann G Gale)



Perkembangan instrumen astronomi

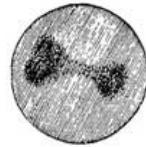


Semakin besar diameter teleskop:

- Dapat melihat objek lebih redup
- Dapat melihat dengan resolusi lebih baik



Fontana 1638



Cassini 1666



Huygens 1672



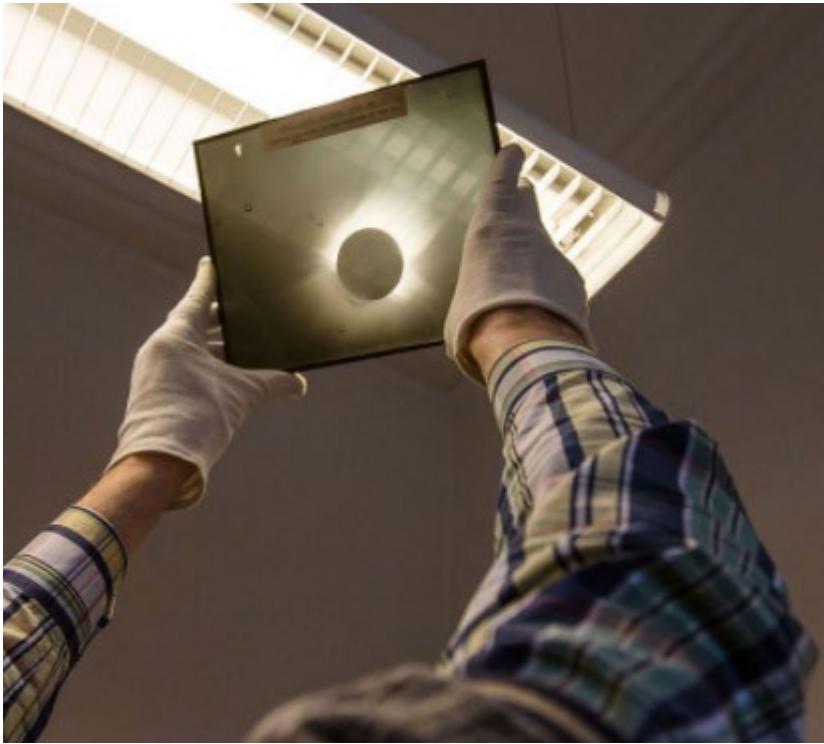
Herschel 1783



De la Rue 1856

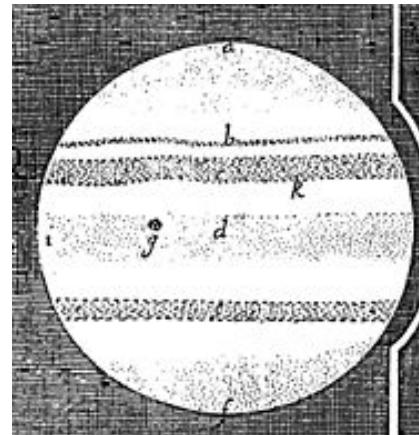


Perkembangan instrumen astronomi: Era Fotografi (1840-an)

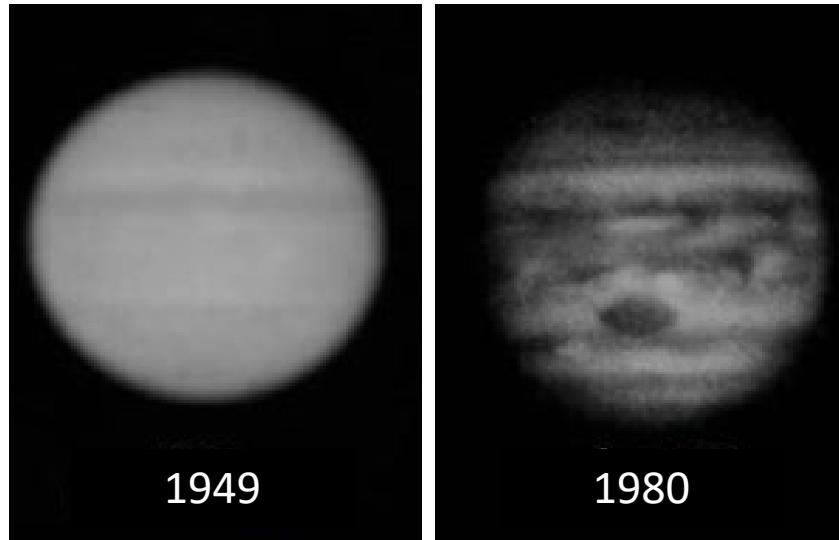


Astronom dapat merekam gambar lebih baik dan dapat mengumpulkan foton lebih lama

Cassini 1666

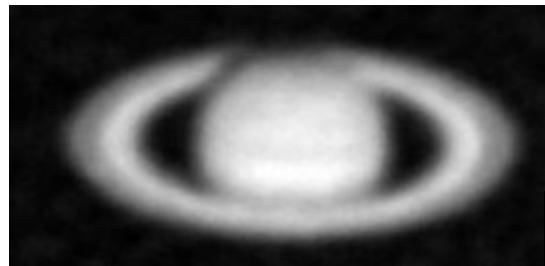
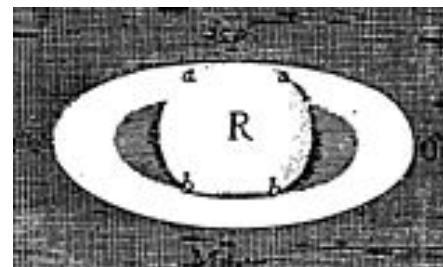


Observatorium Bosscha



1949

1980

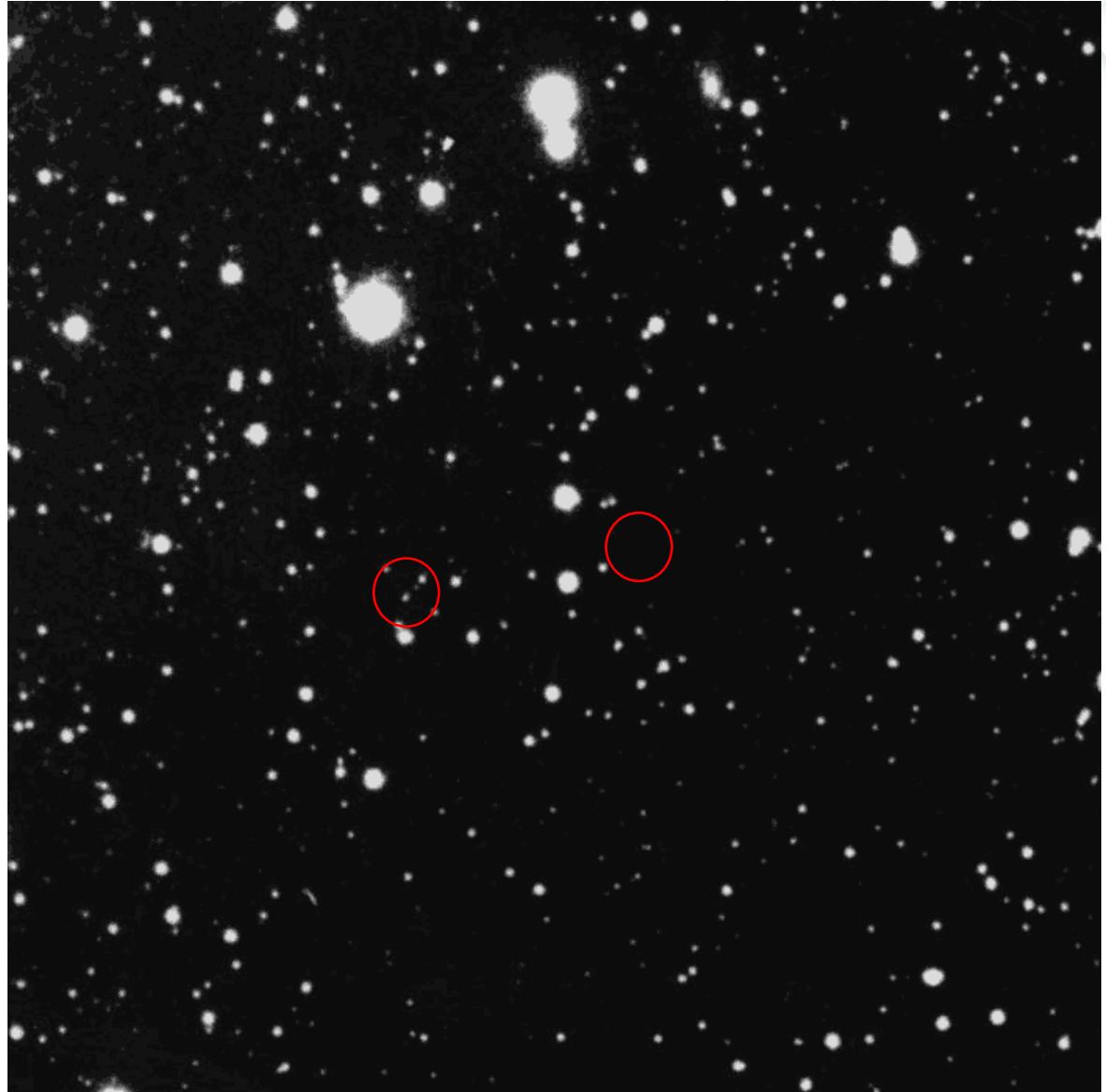


2 Feb 1975

Penemuan [planet]: Pluto (1930)



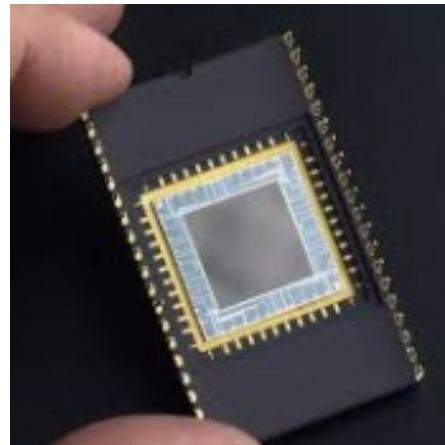
Teleskop yang digunakan Clyde Tombaugh



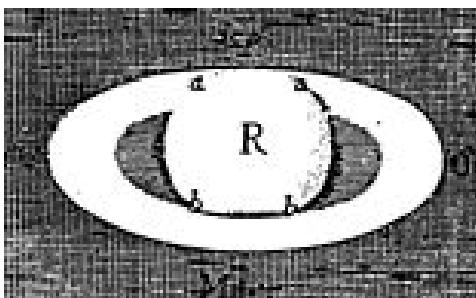
Pengamatan Pluto, Lowell Observatory, 1930



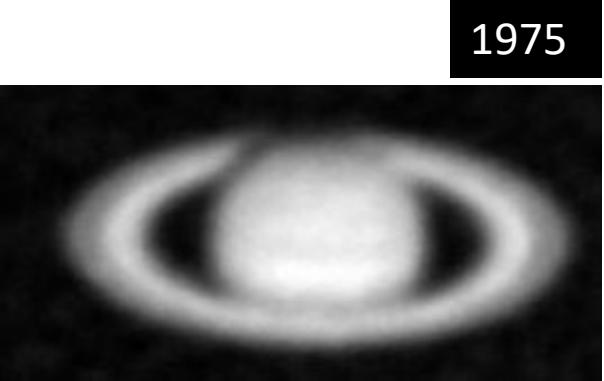
Era Fotografi Digital (1960-an)



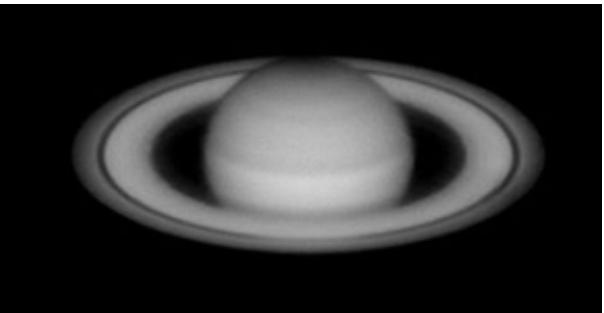
1966



2016



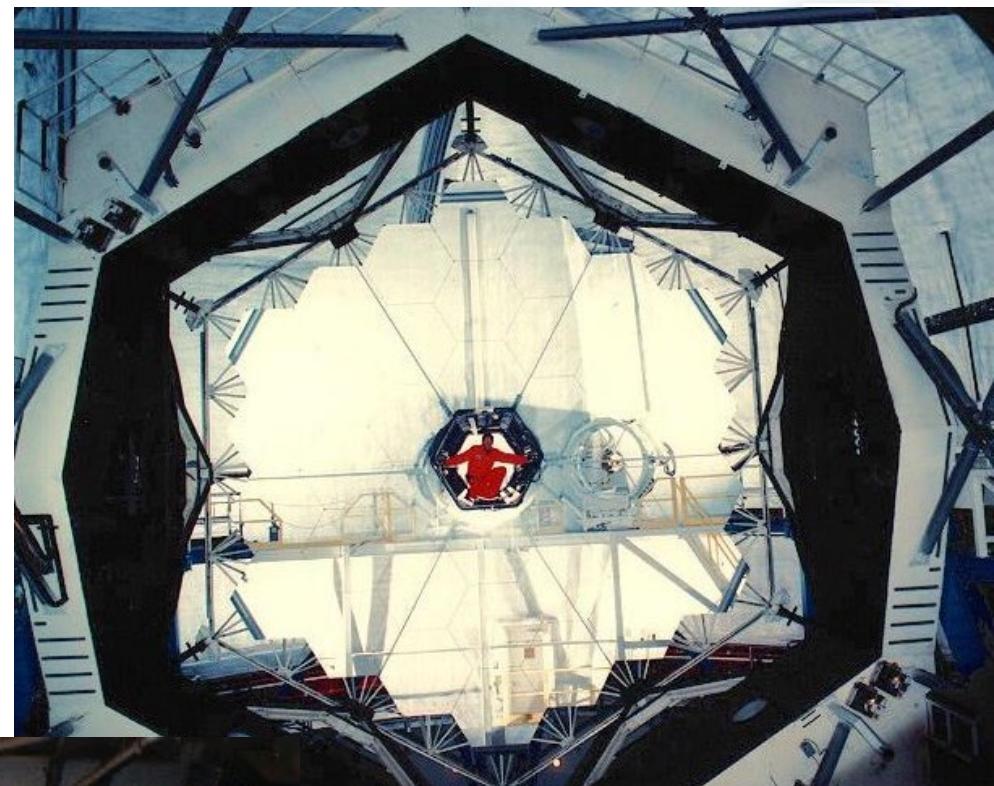
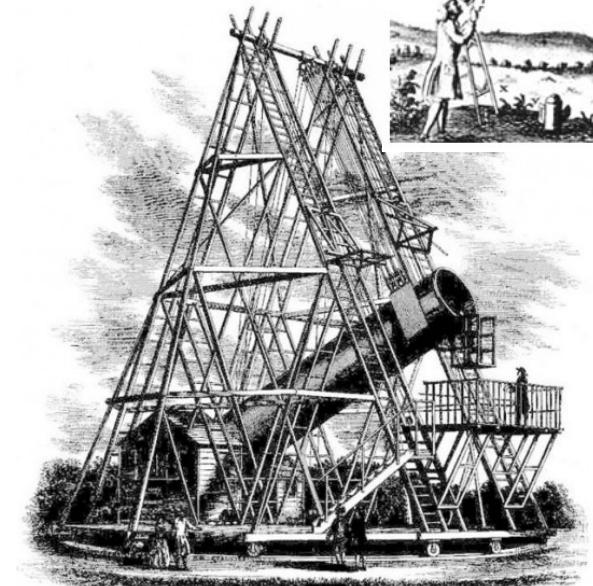
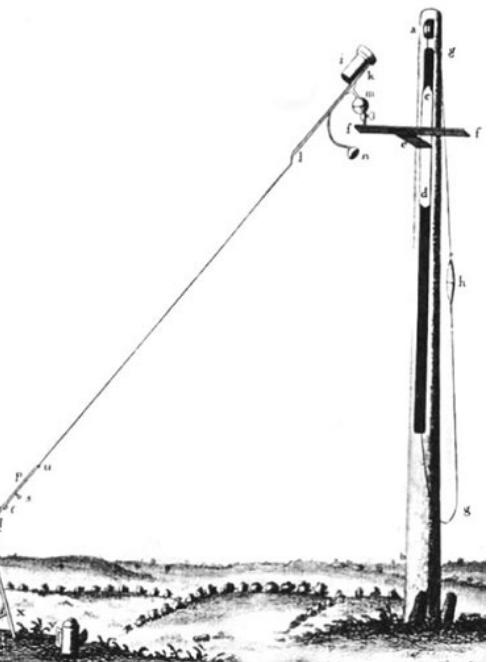
1975



2019

Kamera digital lebih sensitif,
dapat dioperasikan jarak jauh (wahana),
dan data dapat diolah lebih lanjut.

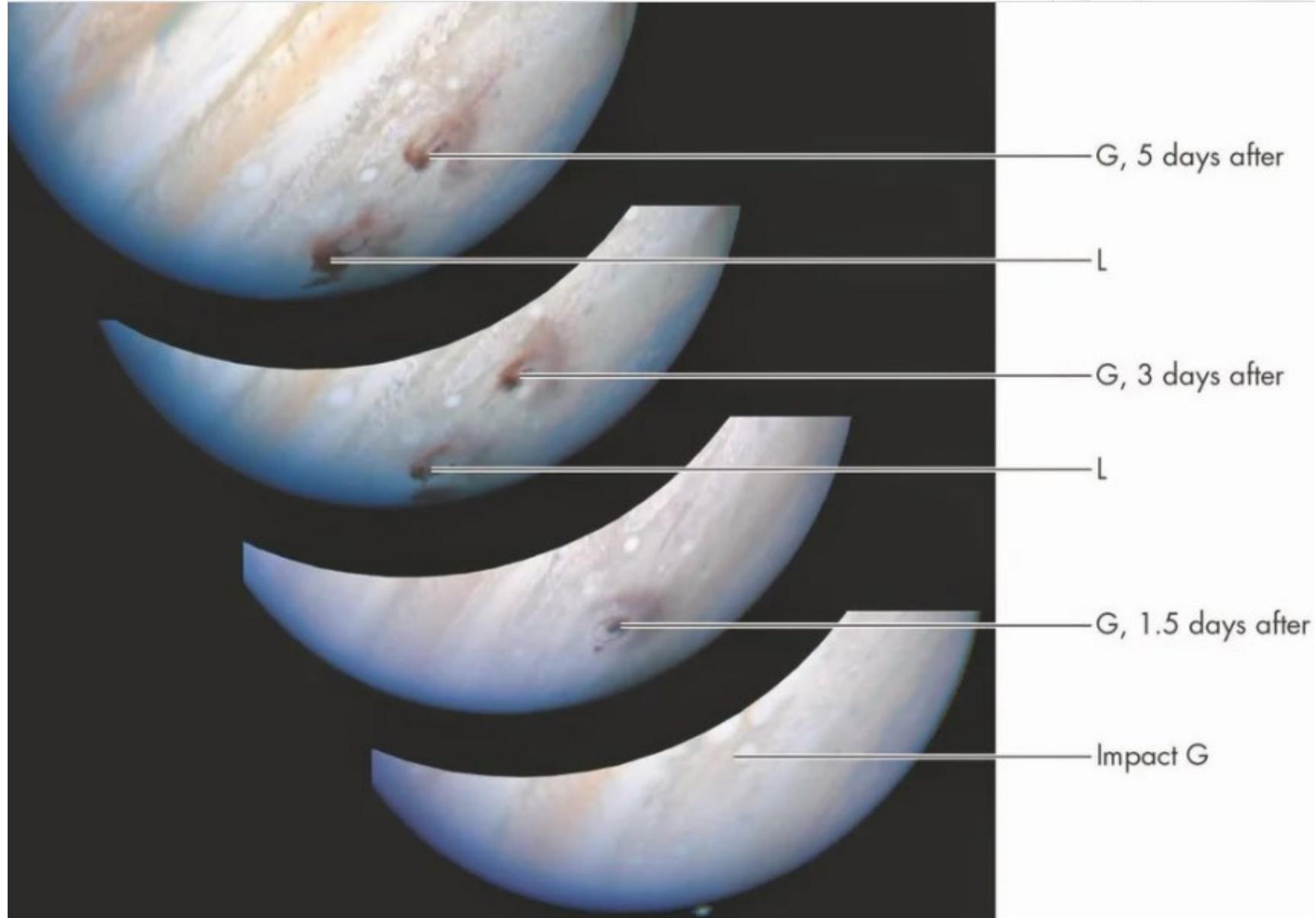
Pembangunan teleskop besar



Teleskop Keck 10 m (1996)

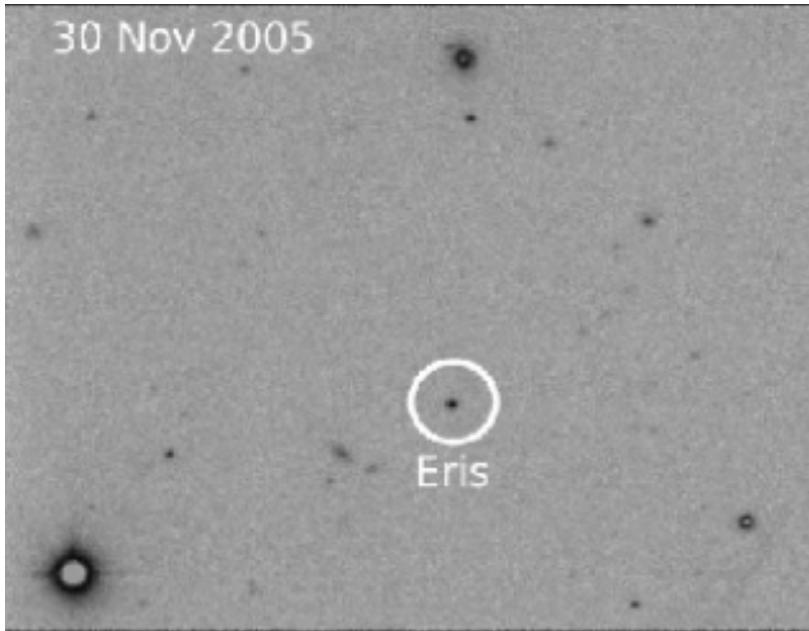
Teleskop LBT 8,4 m (2005)

Pengamatan tumbukan komet Shoemaker-Levy (Juli 1994)

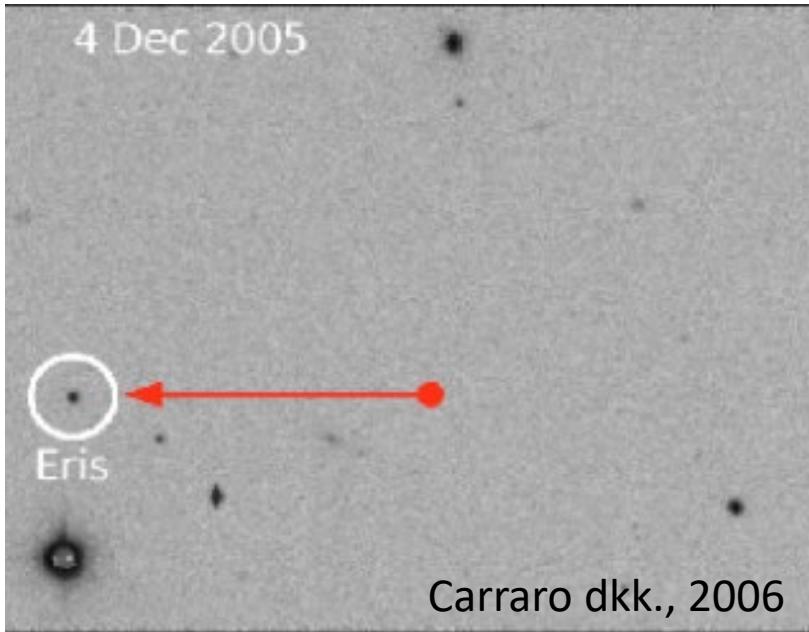


Penemuan planet kerdil

30 Nov 2005



4 Dec 2005



Carraro dkk., 2006



<https://youtu.be/b9ouu3p1e3w> (NASA Spitzer)

IAU GA 2006

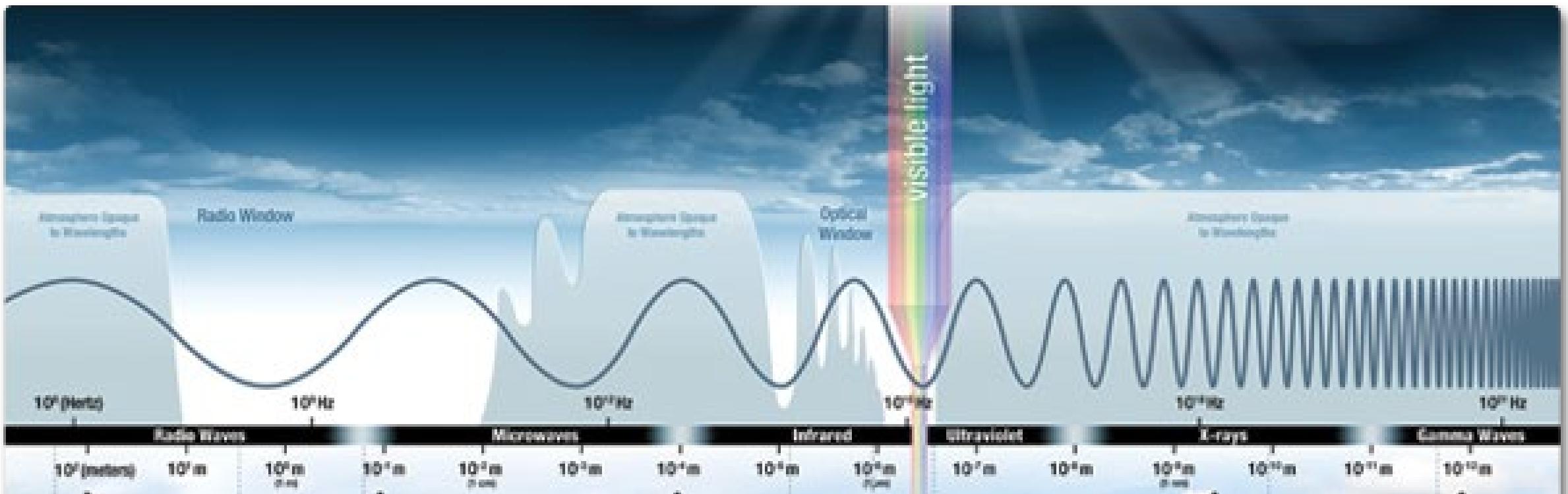
Definisi planet:

- mengorbit matahari
- memiliki massa cukup (nyaris bulat)
- lingkungan orbit bersih

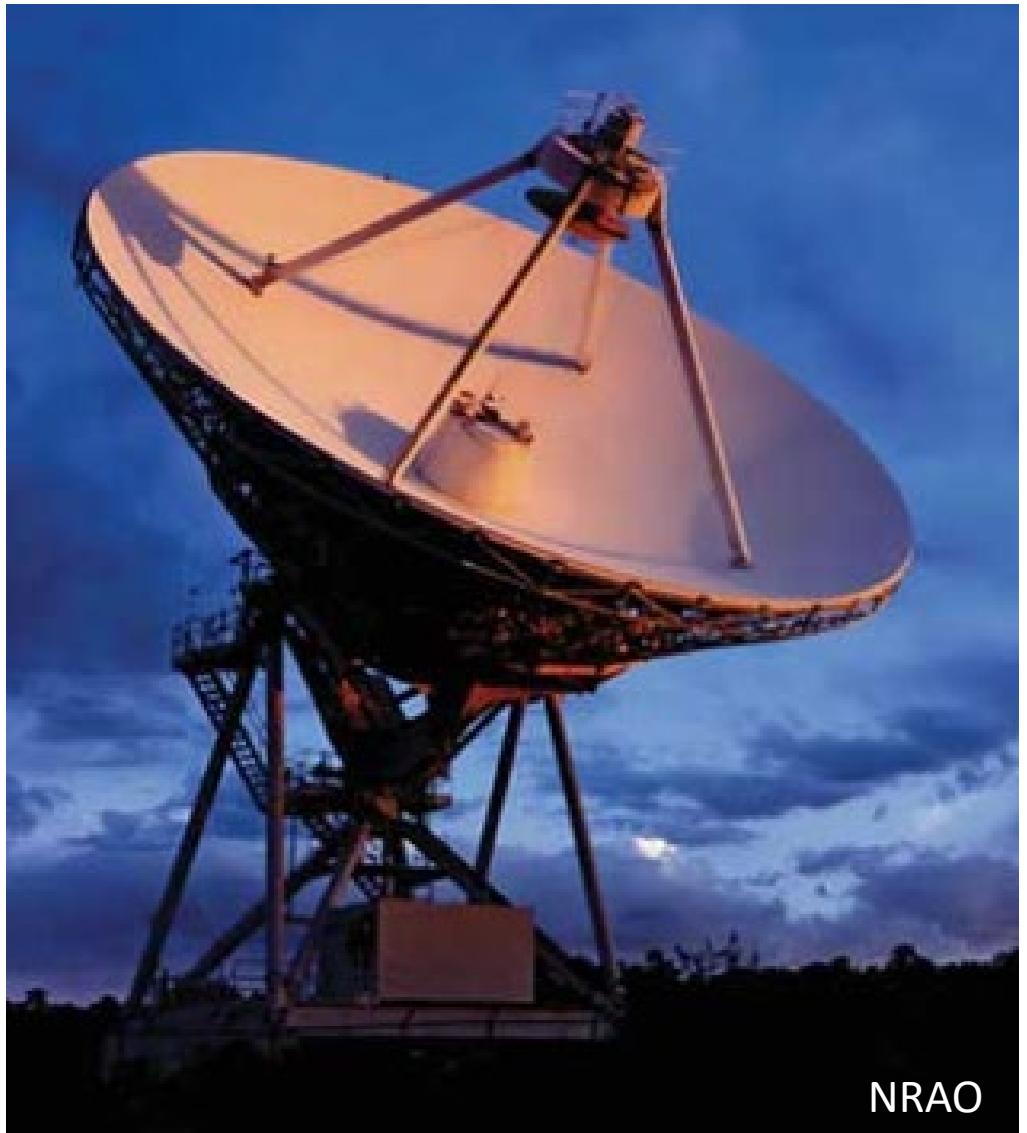


Keterbatasan pengamatan visual (1)

- Objek memancarkan cahaya tidak hanya di visual
- Efek atmosfer: Jendela pengamatan visual & radio

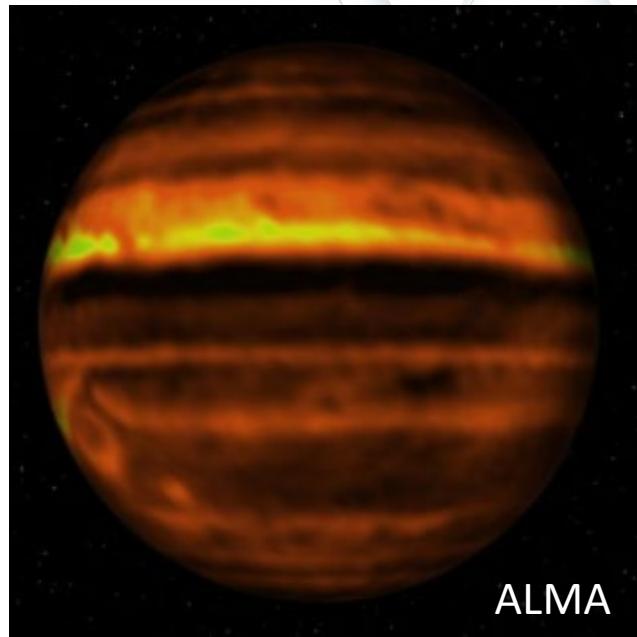


Pengamatan astronomi radio (sejak 1937)

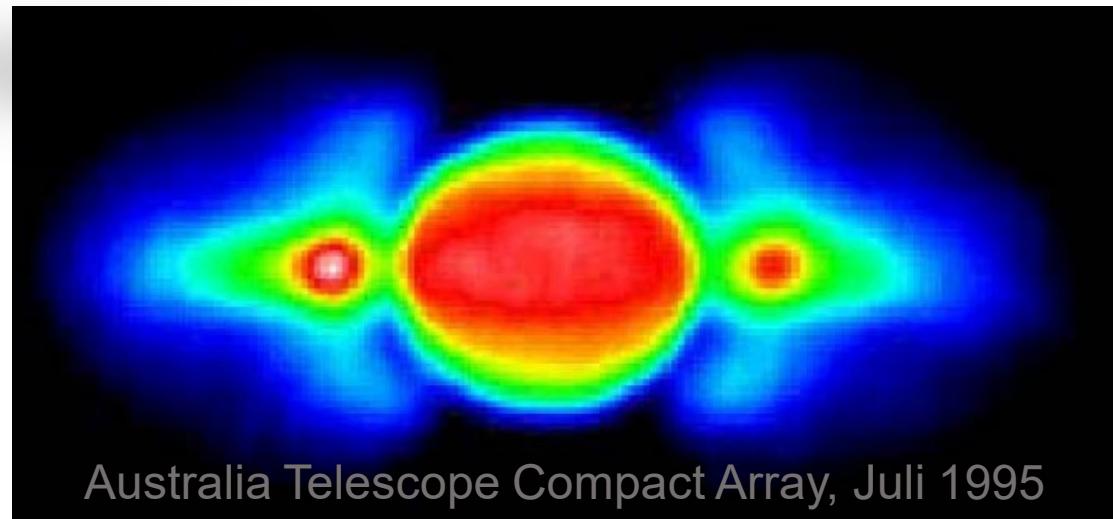


NRAO

HST, Feb 1995



ALMA



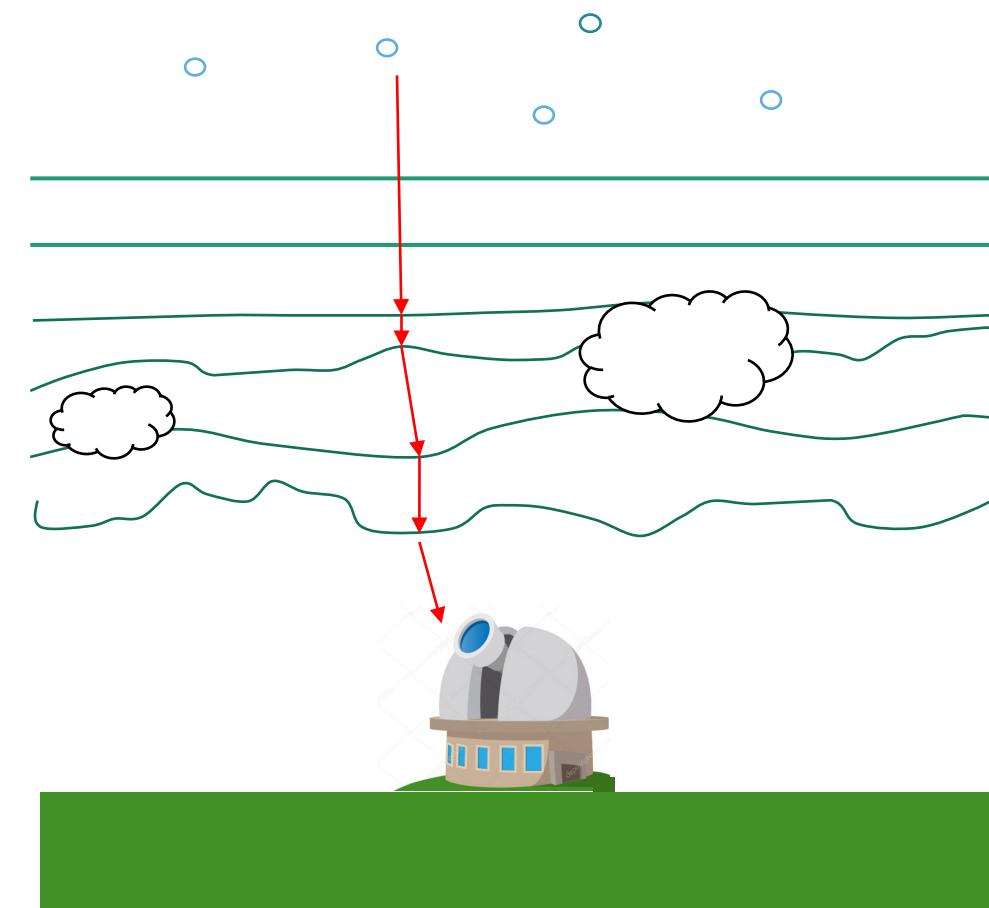
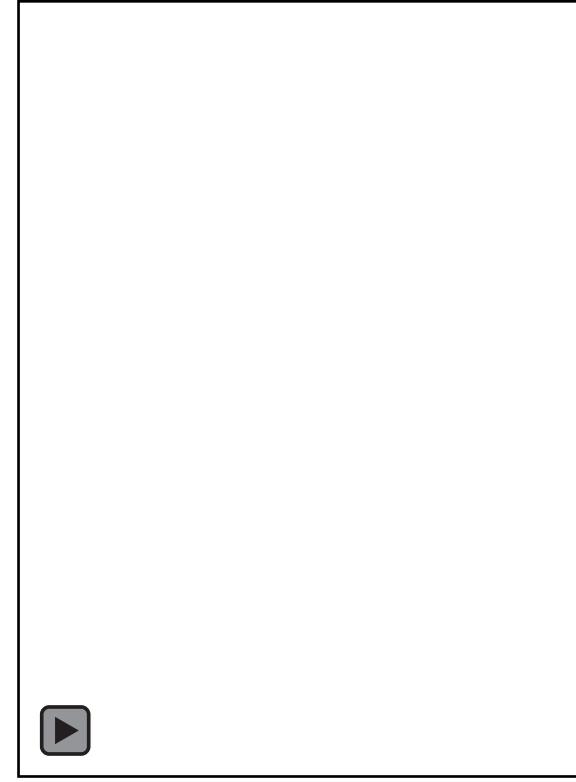
Australia Telescope Compact Array, Juli 1995

Keterbatasan pengamatan astronomi visual (2)

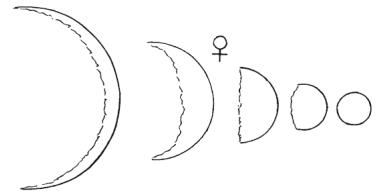


Gangguan atmosfer: turbulensi udara/seeing

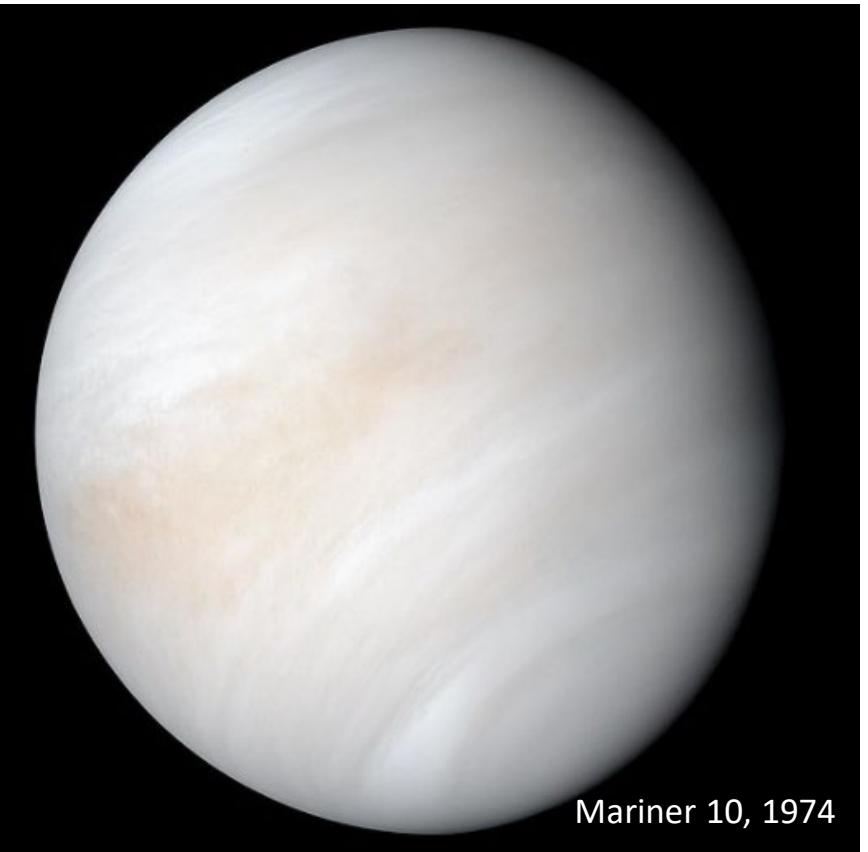
Astronom perlu mengirimkan teleskop dan wahana ke luar angkasa



Perkembangan pengetahuan astronomi: Venus

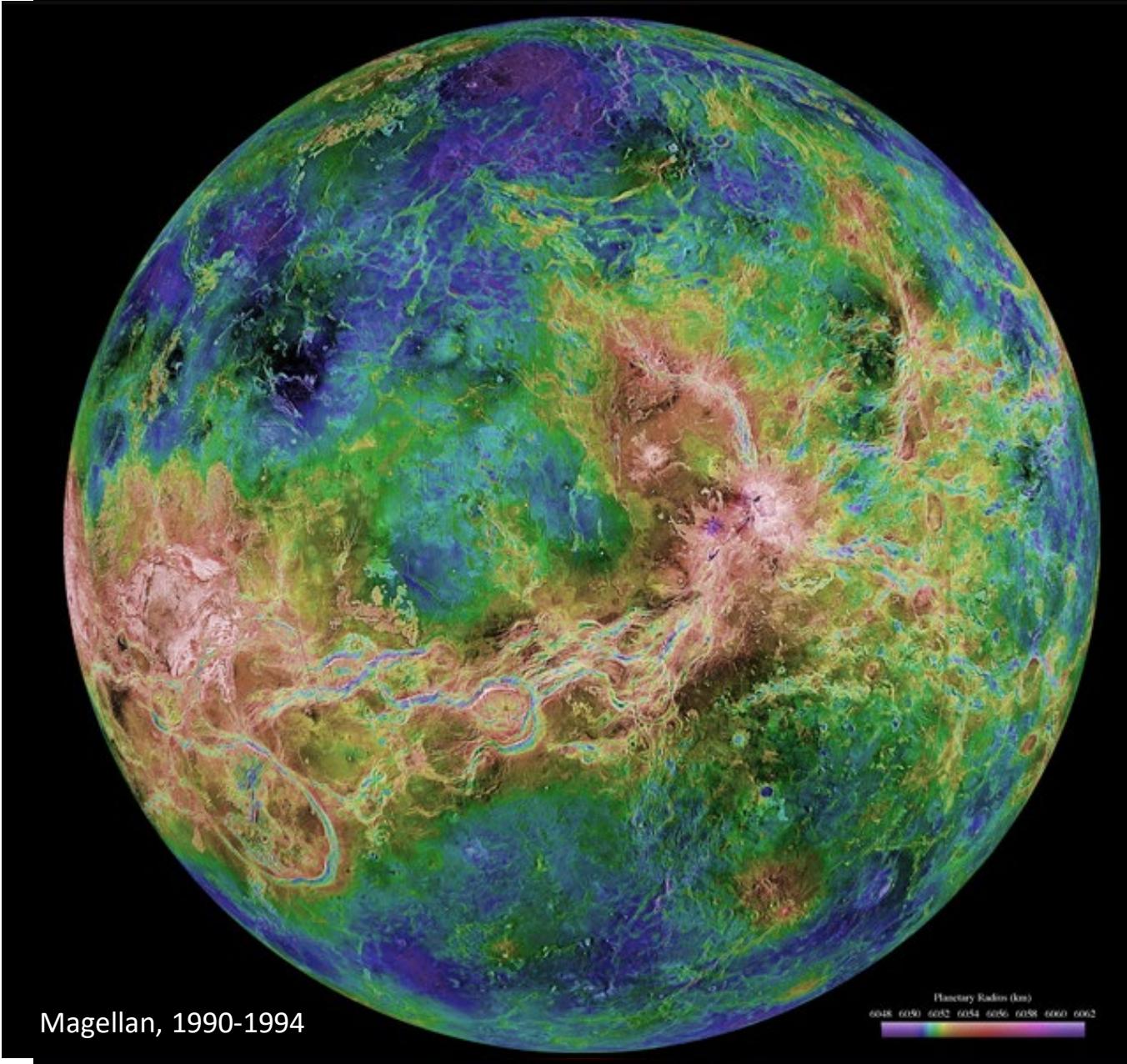


Galileo 1610



Mariner 10, 1974

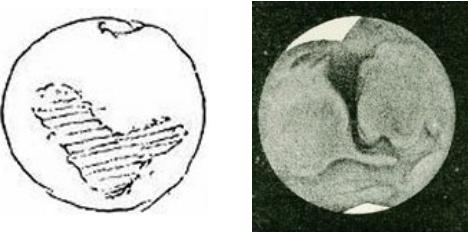
Venus secara visual



Magellan, 1990-1994

Venus dengan radar

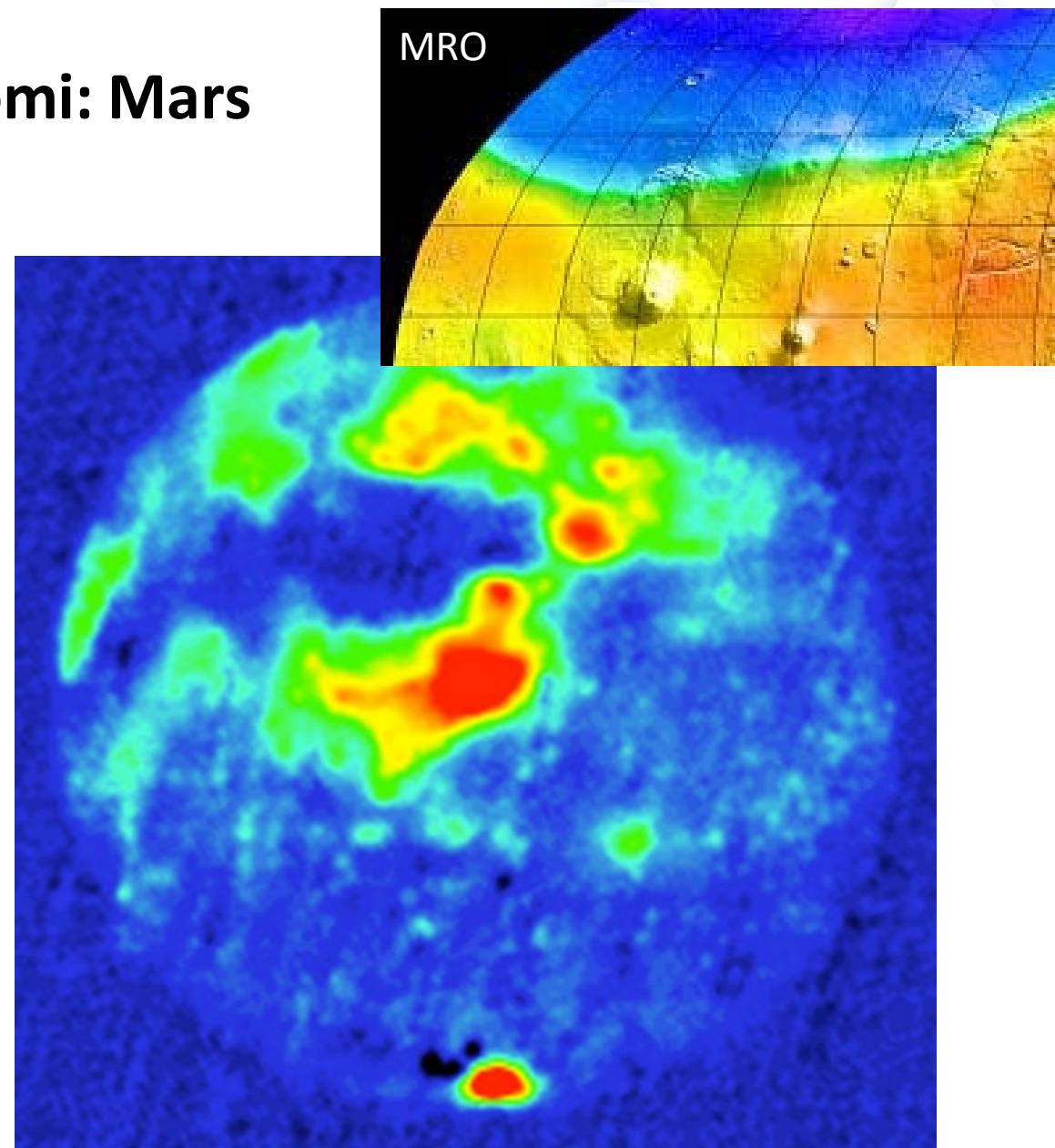
Perkembangan pengetahuan astronomi: Mars



Huygens 1672 De la Rue 1856



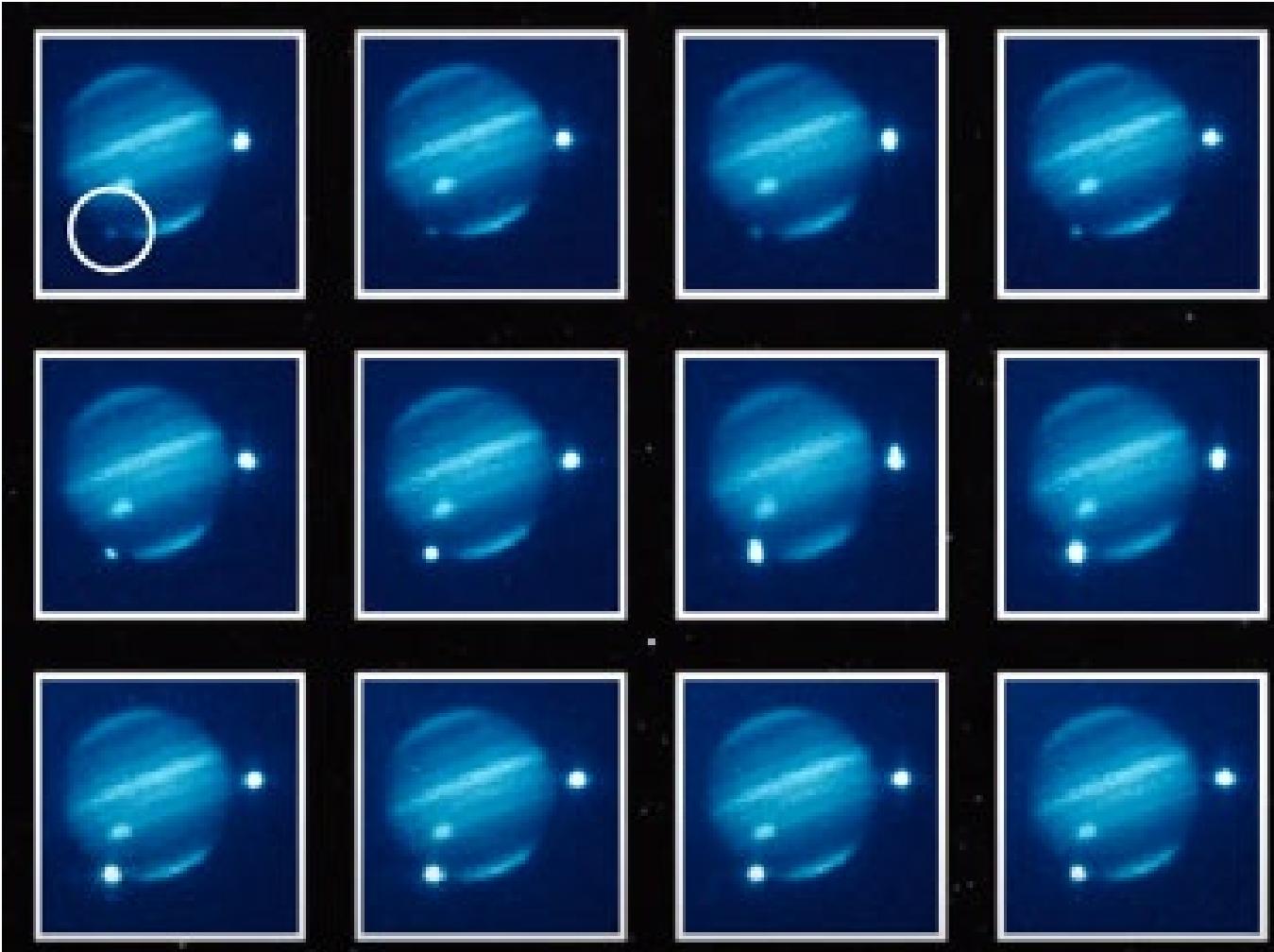
Badai debu di Mars (Damien Peach/Anthony Wesley)



VLA radar: geologi Mars



Perkembangan pengetahuan astronomi: Jupiter (1)



SAAO, Stobie & Whitelock, 1996

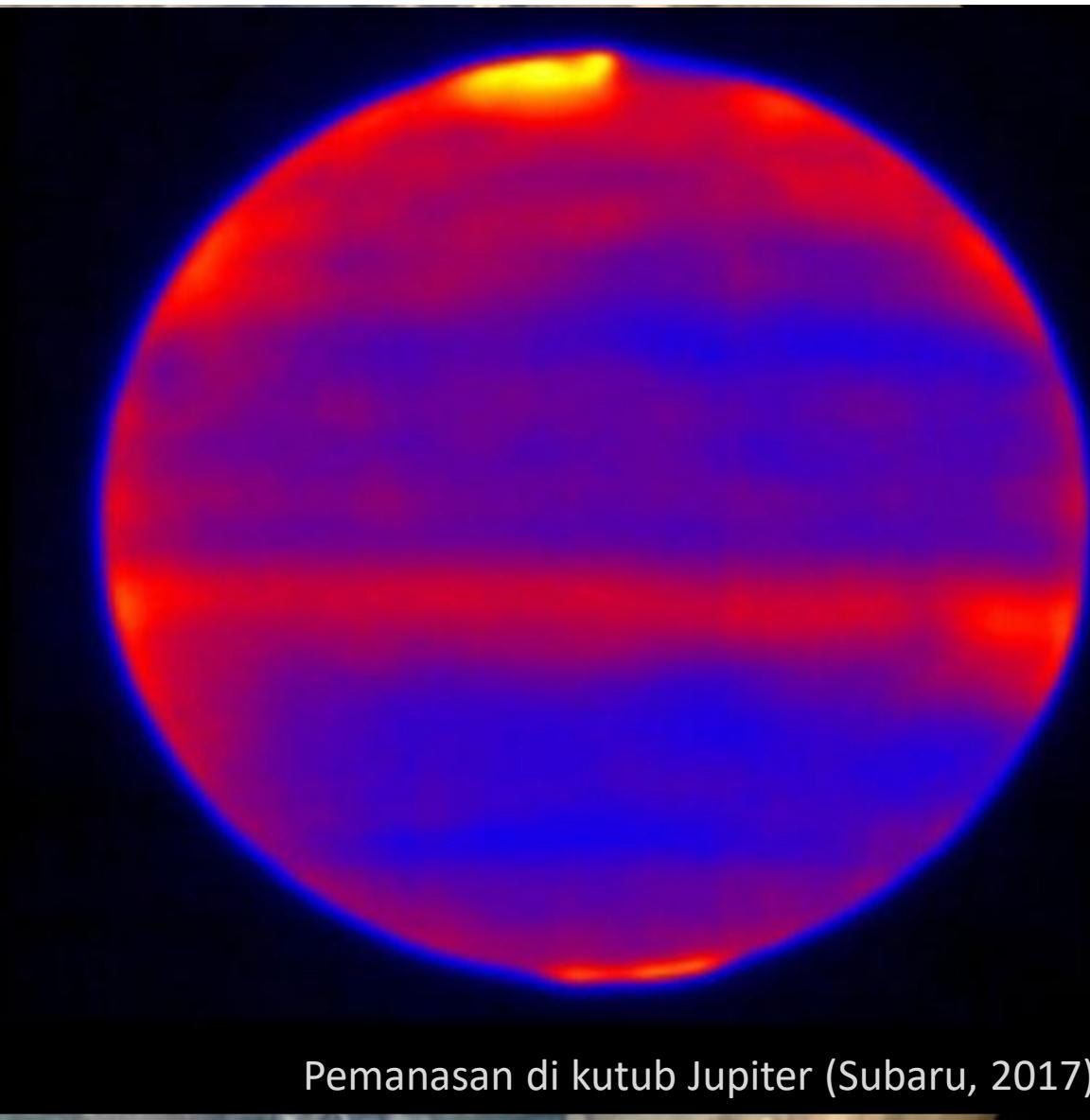


Voyager 1

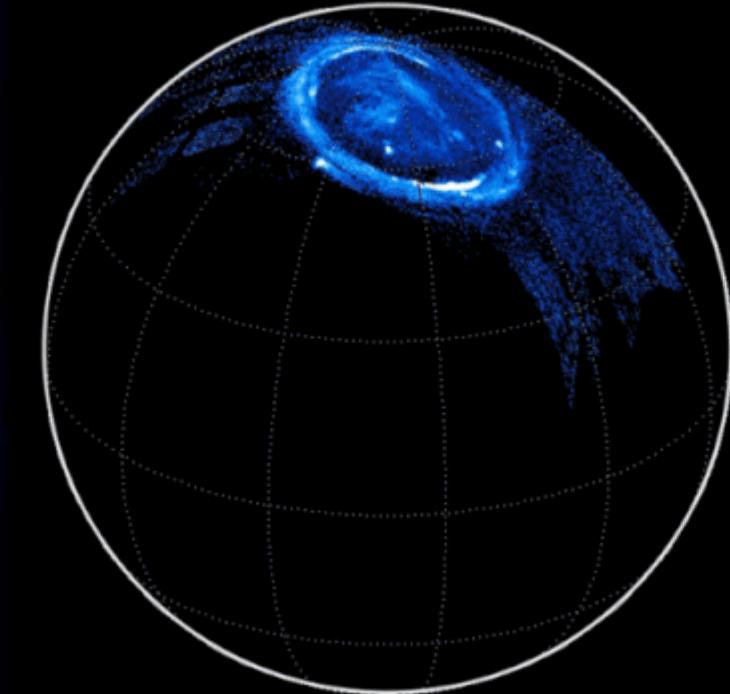


Perkembangan pengetahuan astronomi: Jupiter (2)

Kutub selatan Jupiter dari Juno (NASA)

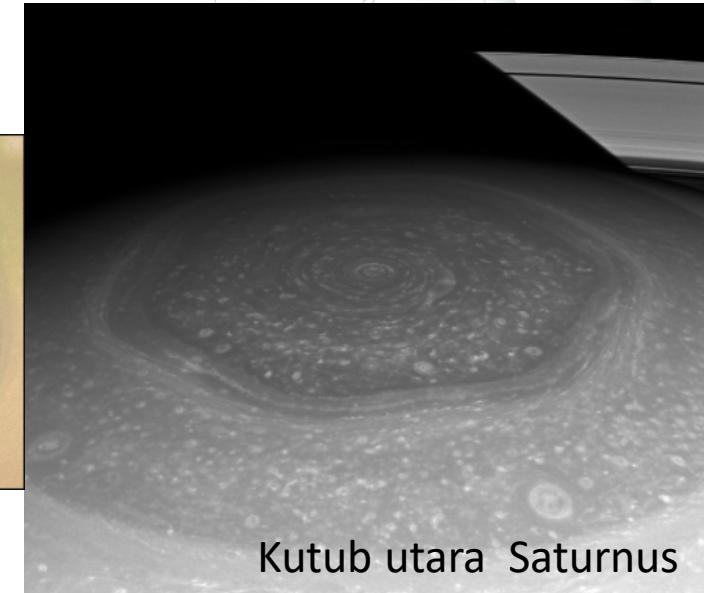
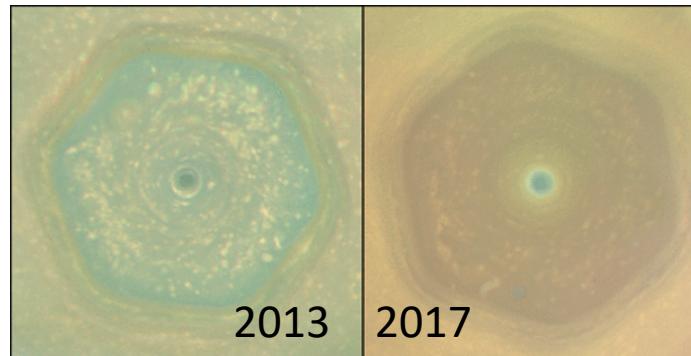
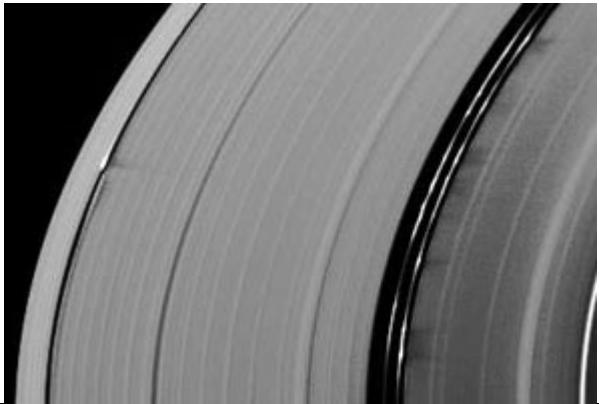


Pemanasan di kutub Jupiter (Subaru, 2017)

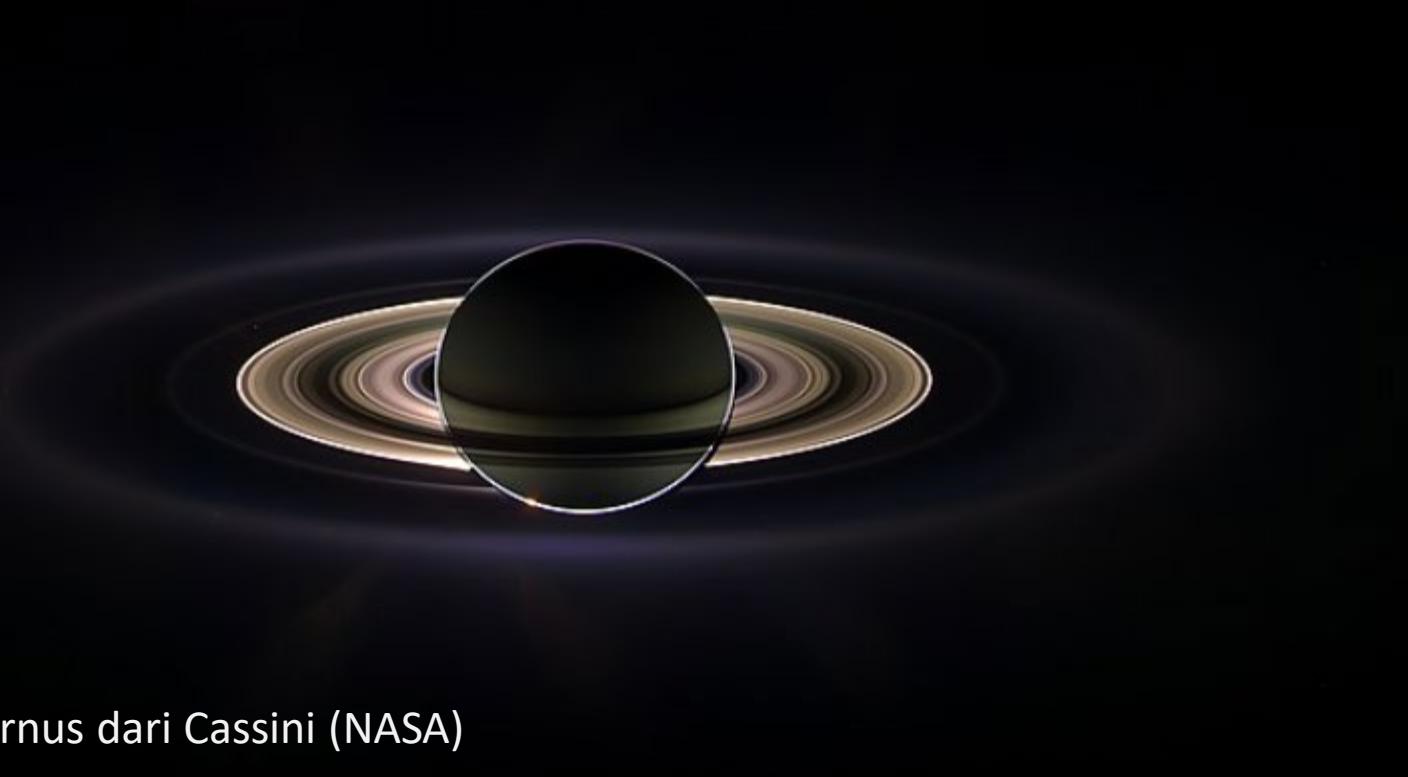


Aurora di Jupiter (NASA)

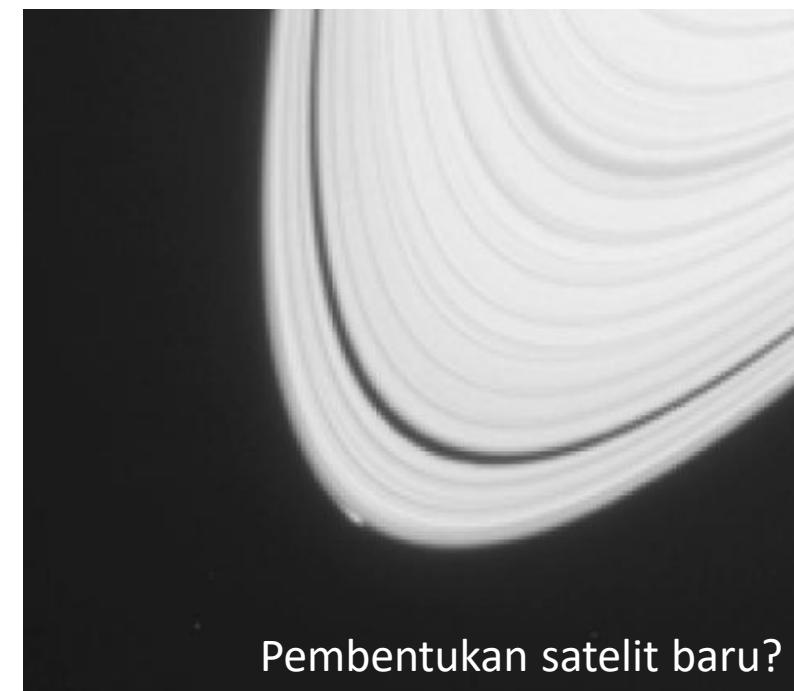
Perkembangan pengetahuan astronomi: Saturnus



Kutub utara Saturnus



Cincin Saturnus dari Cassini (NASA)



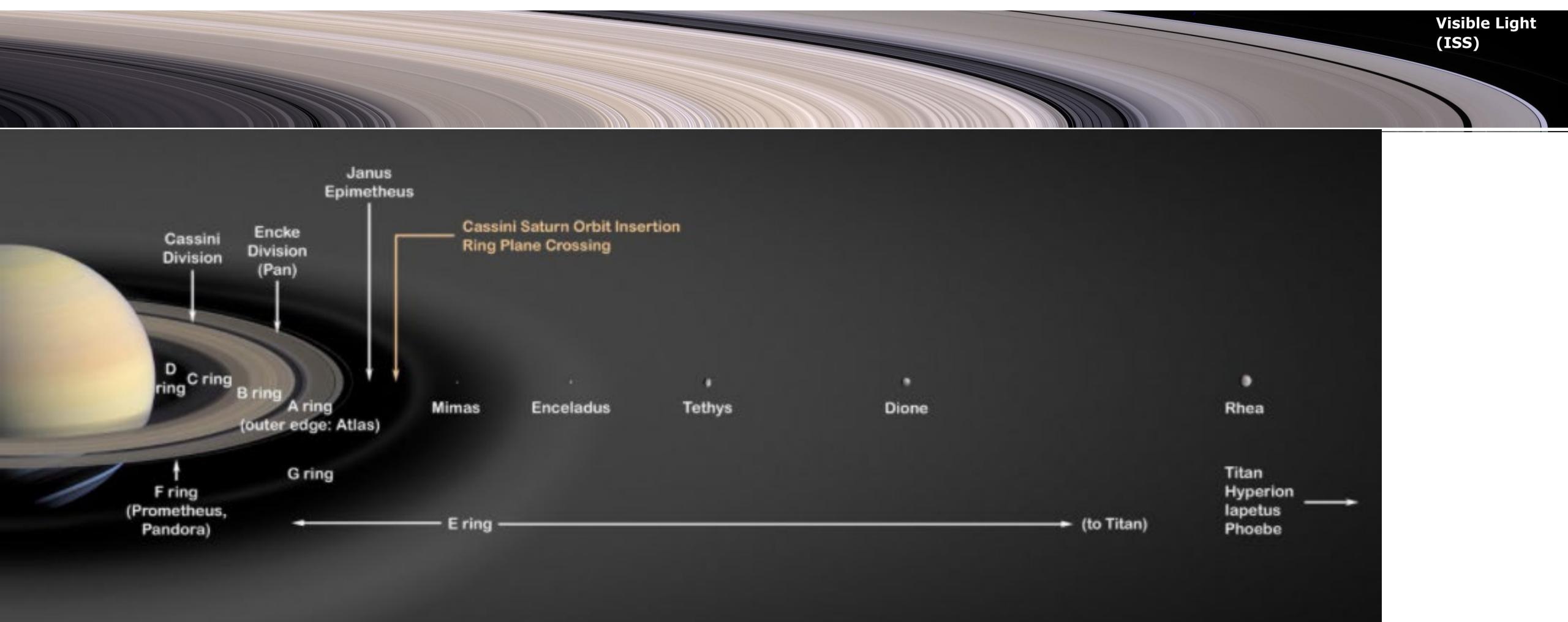
Pembentukan satelit baru?



Apakah pengetahuan kita seputar planet sudah lengkap?



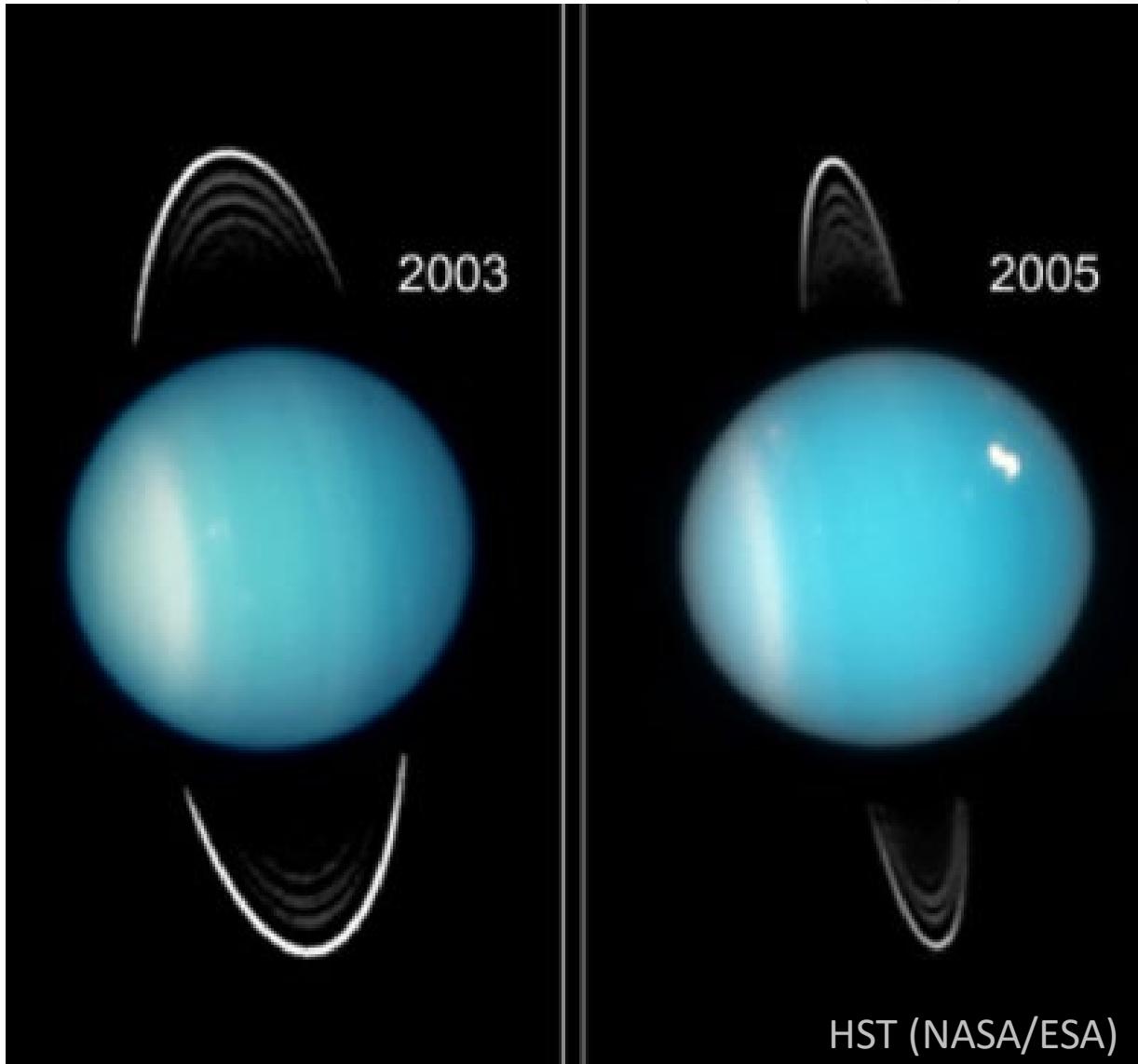
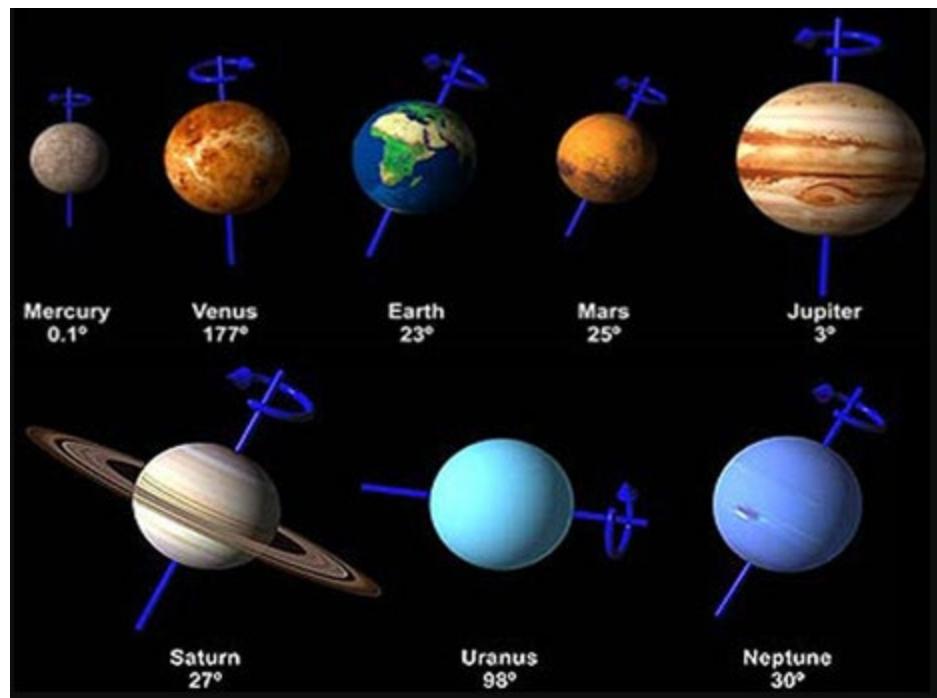
Bagaimana cincin saturnus terbentuk?



Apakah pengetahuan kita seputar planet sudah lengkap?



Mengapa sumbu rotasi Uranus
sangat miring?





net sudah lengkap?

