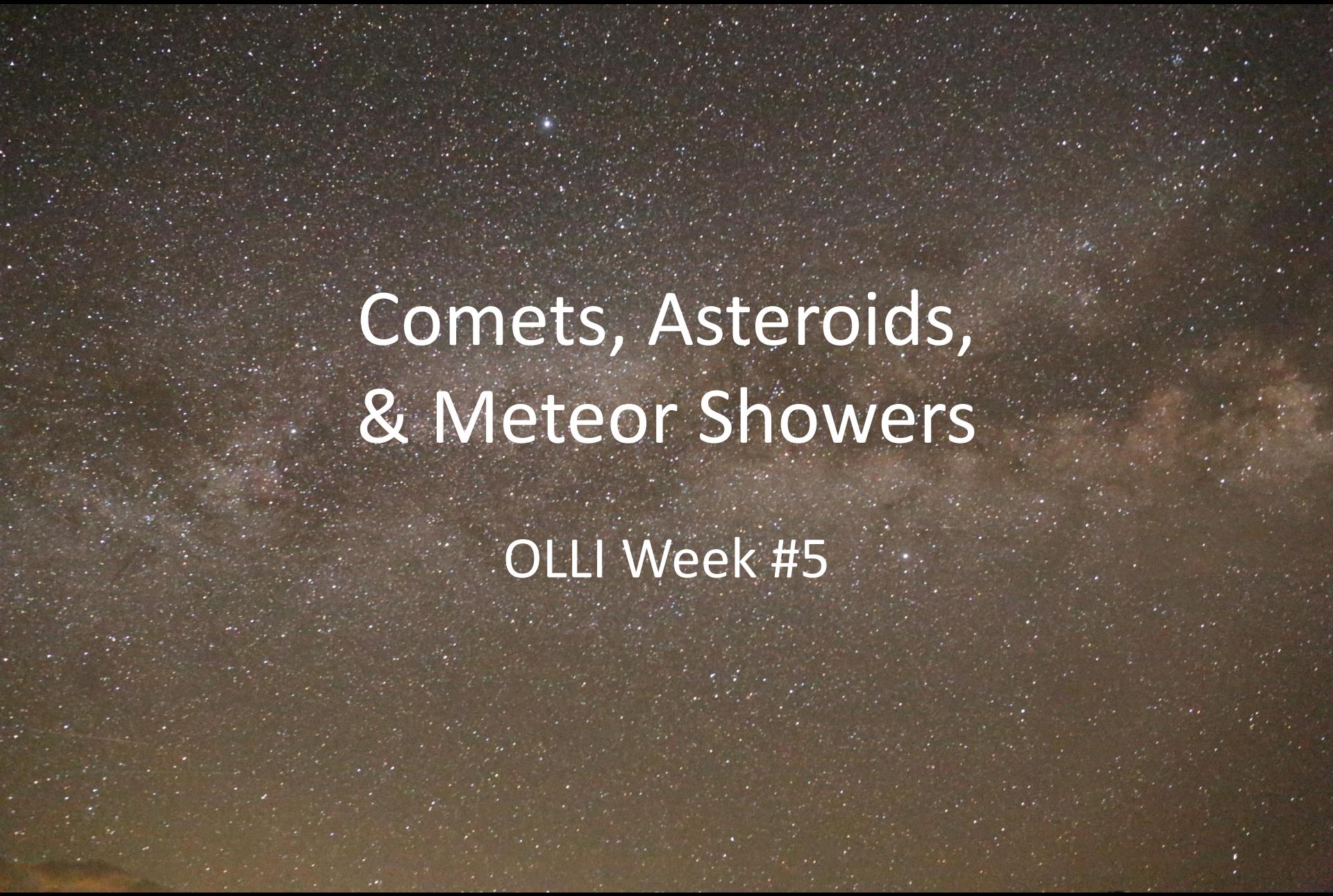


Comets, Asteroids, & Meteor Showers

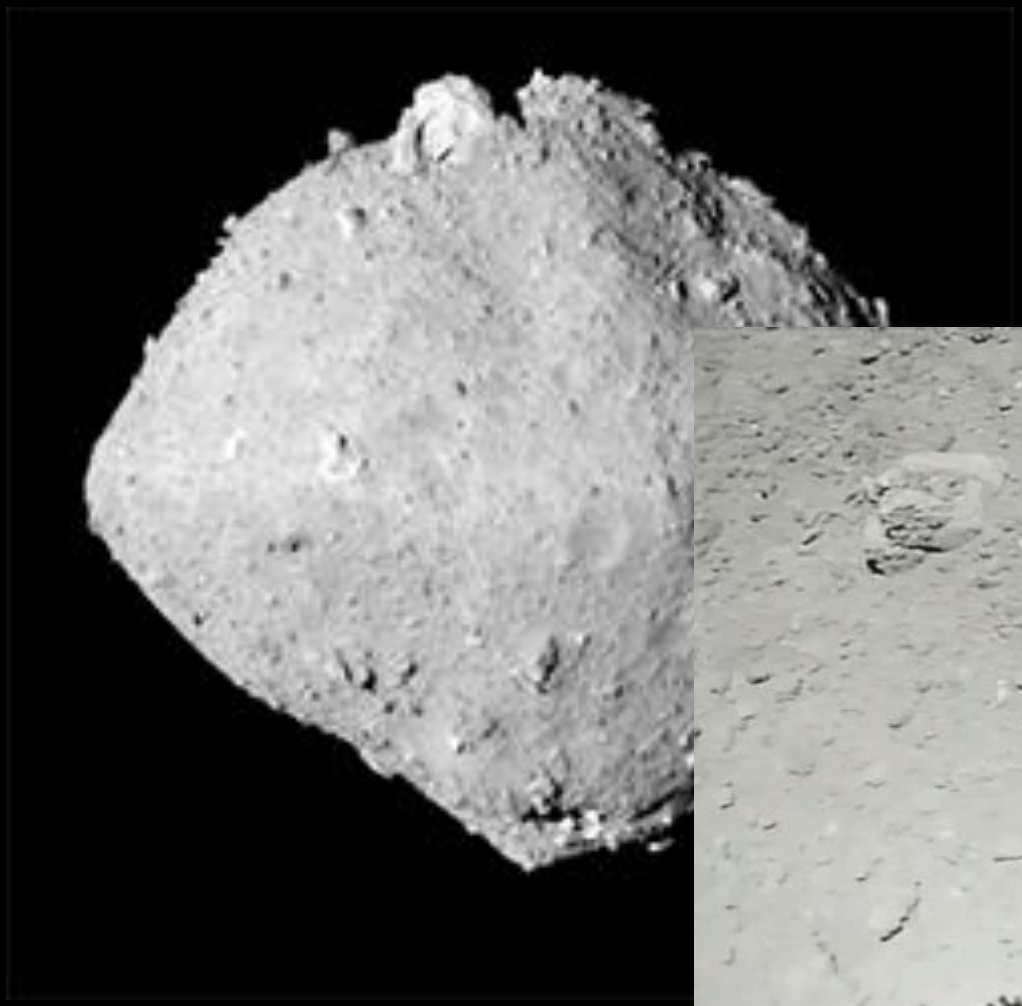
OLLI Week #5

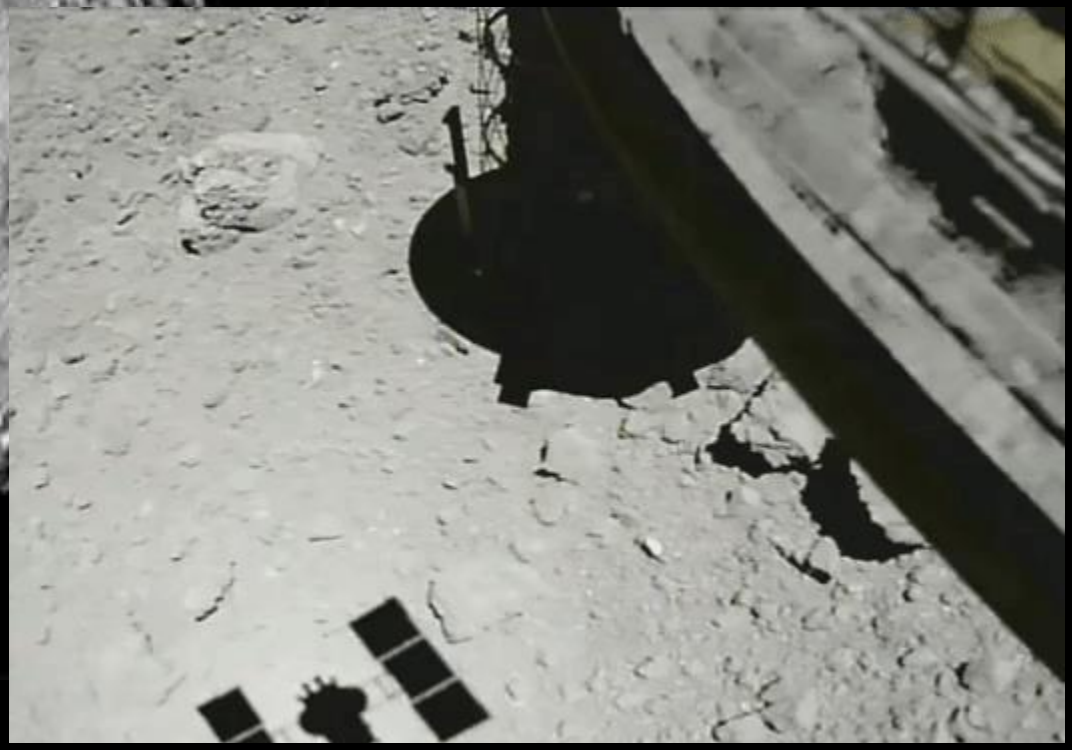
Asteroids

Gaspra from *Galileo*

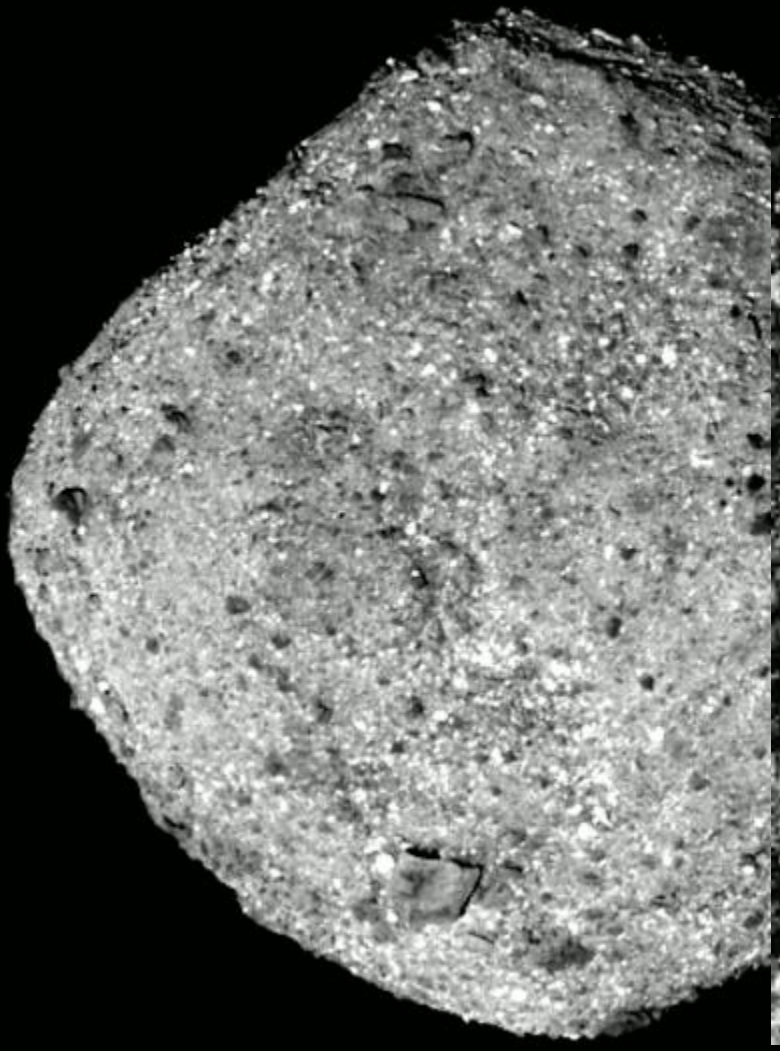
Smallest craters ~350 ft.

Hayabusa 2 at Ryugu





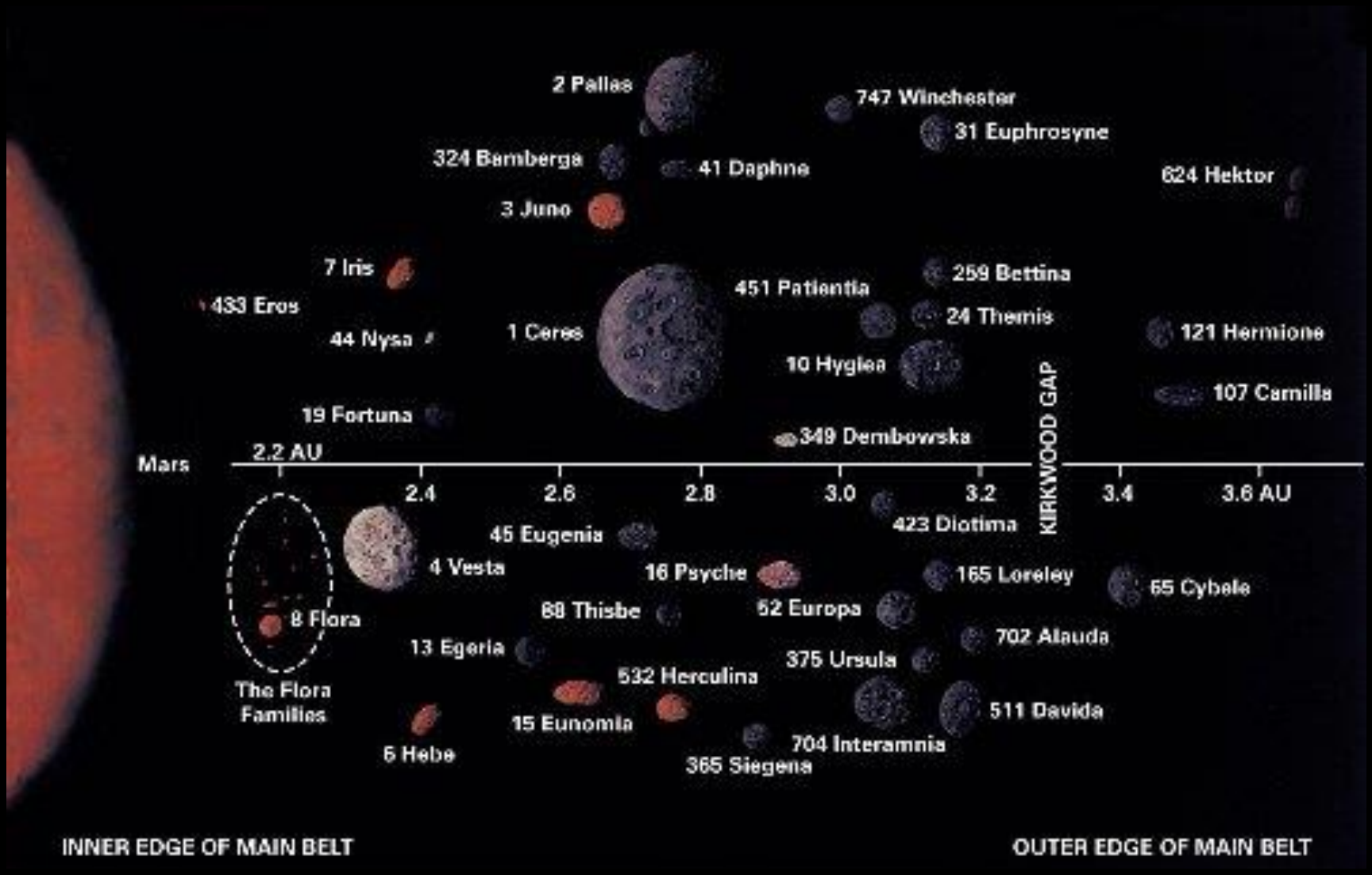
OSIRIS-REX at Bennu



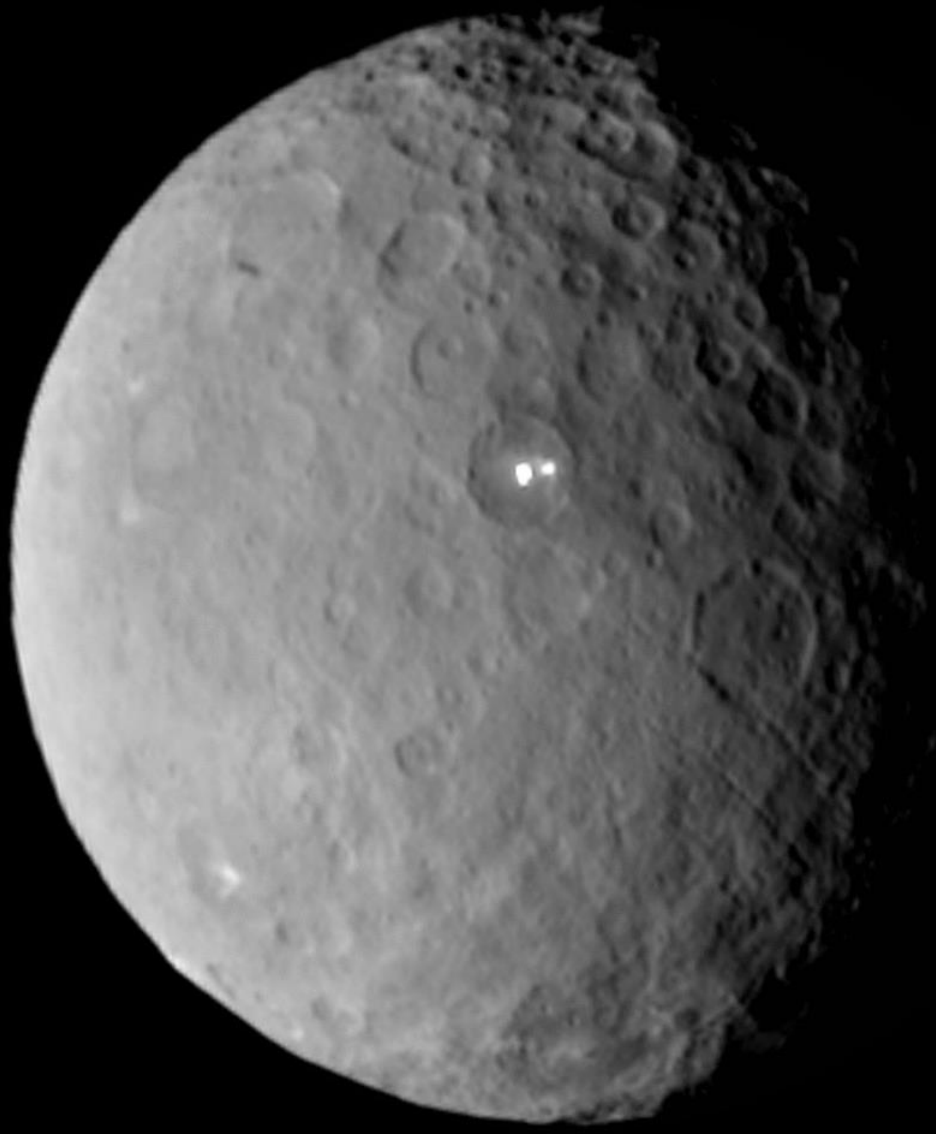
So . . What do they look like?

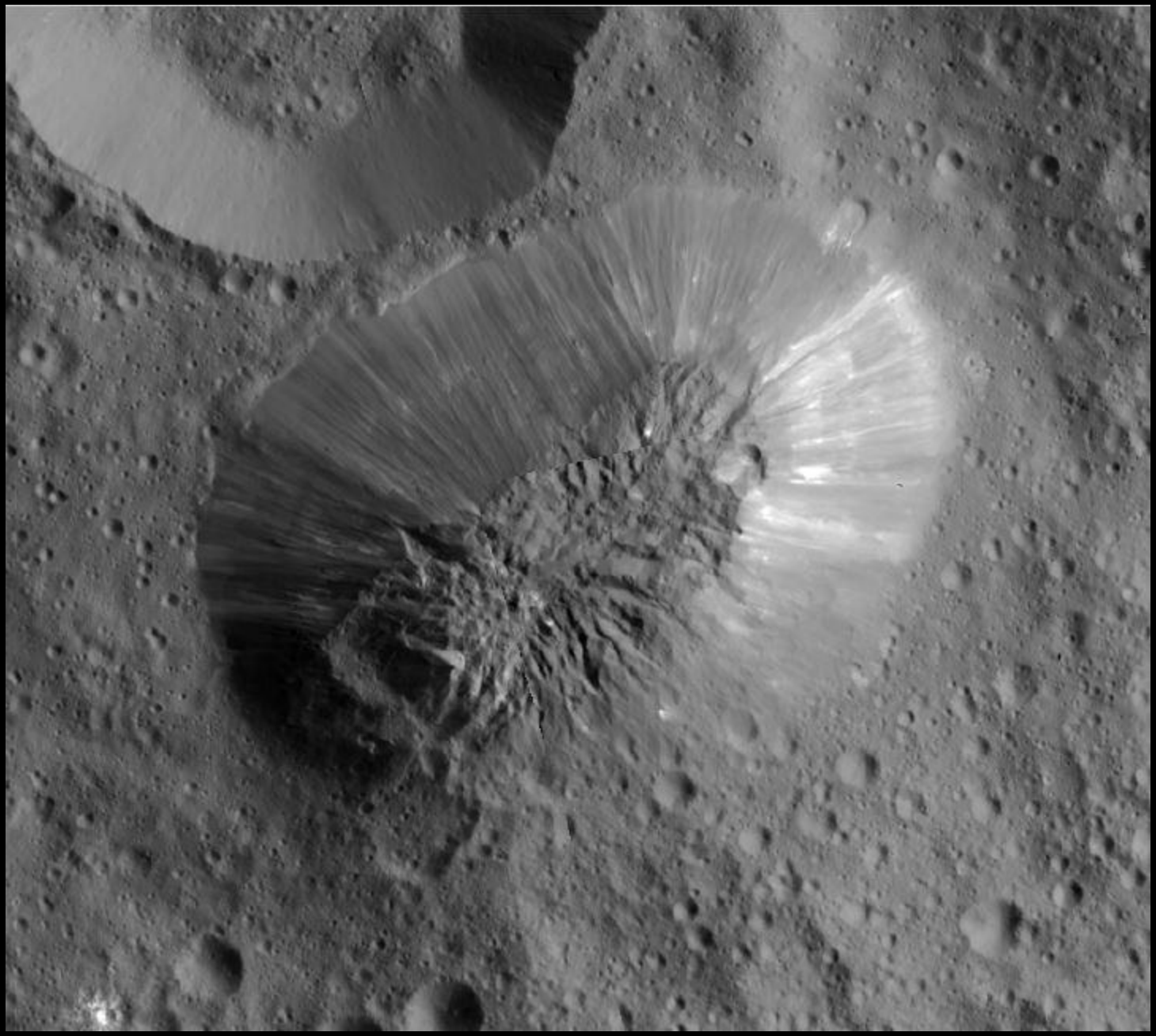
Lets play . . .find the asteroid

Pallas, Juno, Vesta, etc

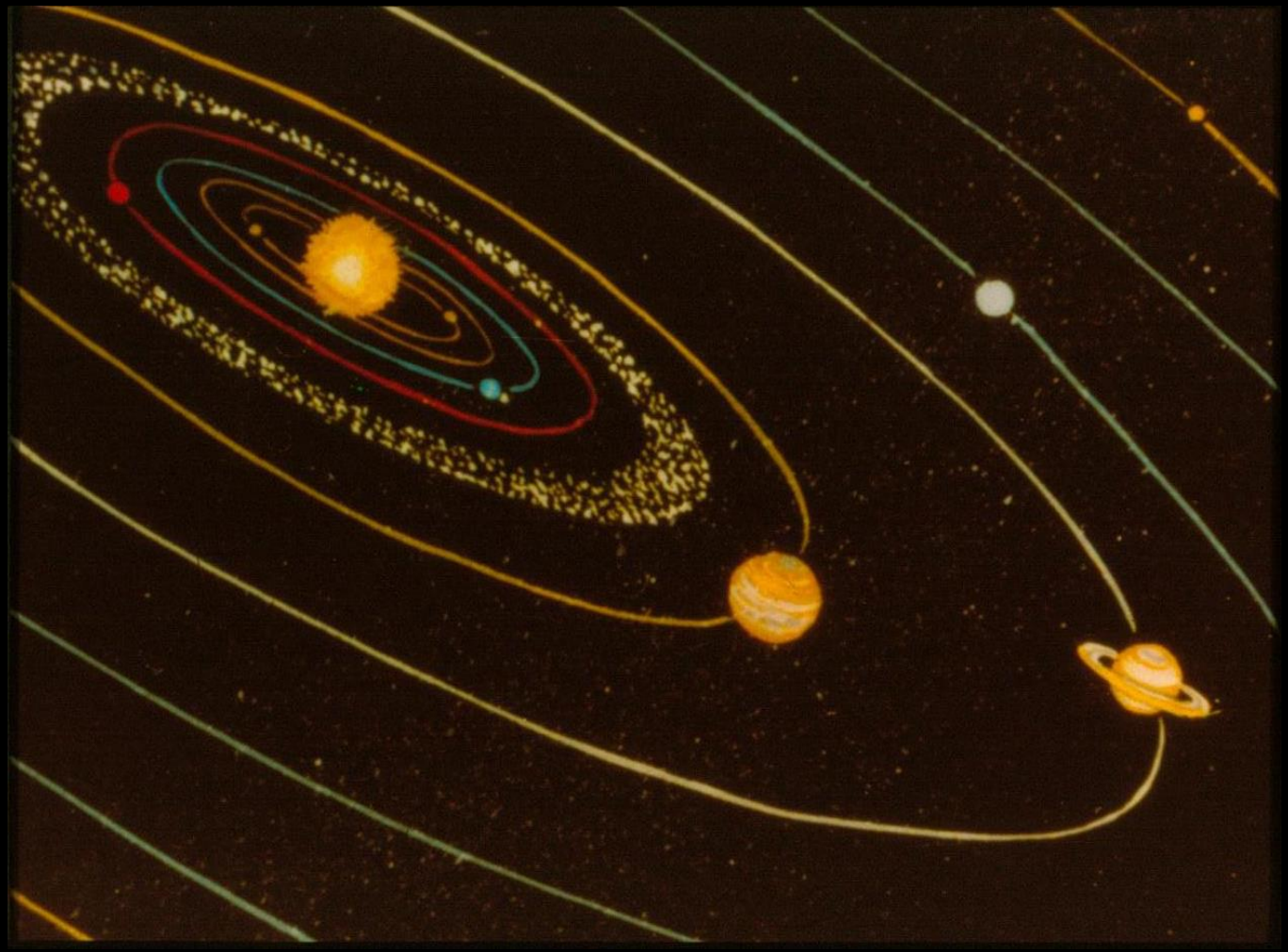


Ceres (dwarf planet)



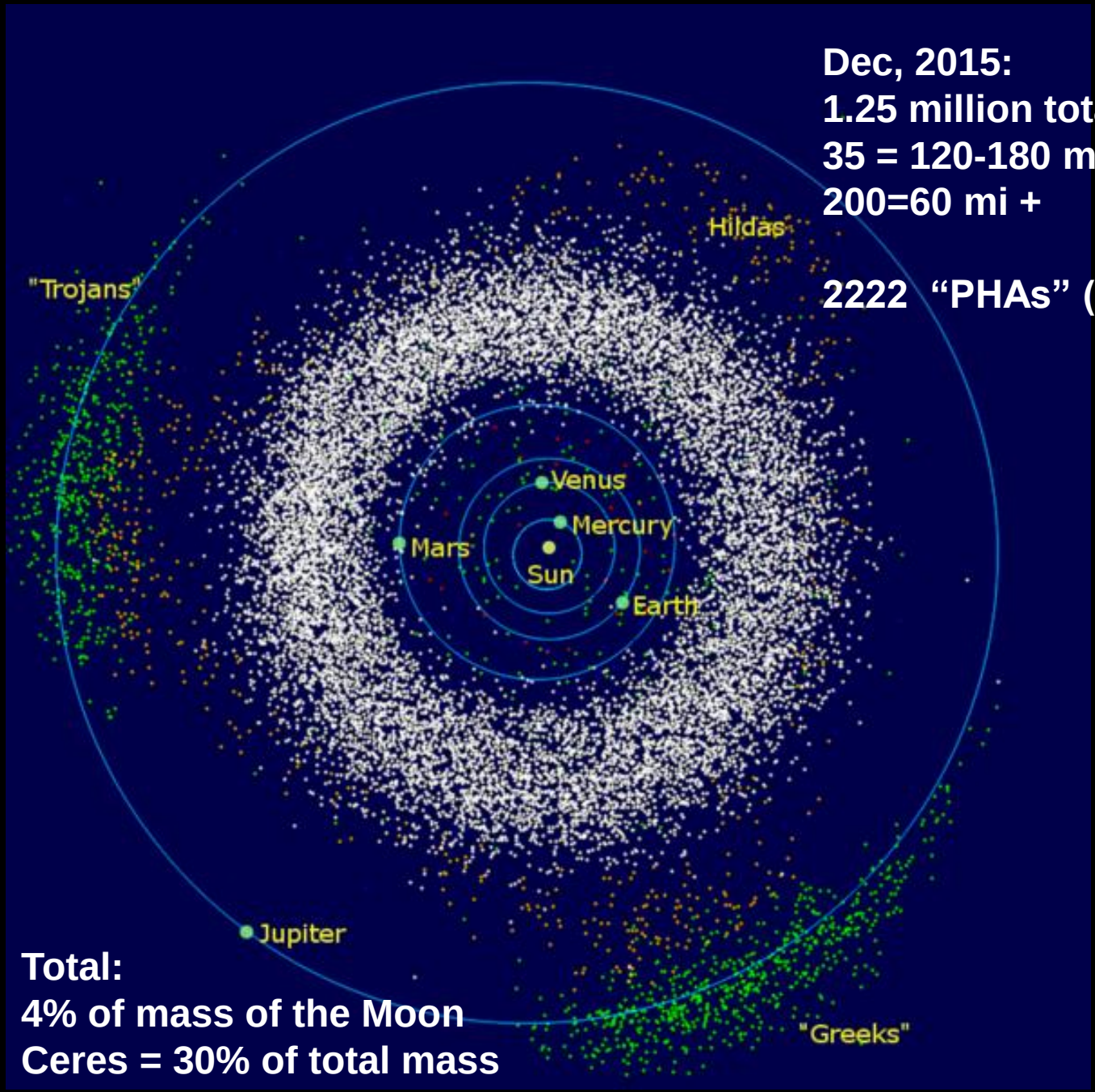


This isn’t your parent’s asteroid belt . . . .



What? There's more?*

- Main belt . . . 2-4 A.U. 971,829 objects, 235 at >120 miles dia. Mass $<M_{moon}$
- Trojans = ahead/behind Jupiter (8622)
- Apollos = Earth-crossing (13,396)
- Amors = Mars crossing (9013)
- Atens = closer than Earth (1858)
- Centaurs = outer sol. sys. *as of Nov 2020
- . . . . Check this out . . . .



Dec, 2015:
1.25 million total
35 = 120-180 mi
200=60 mi +

2222 "PHAs" (10/11/21)

Total:
4% of mass of the Moon
Ceres = 30% of total mass

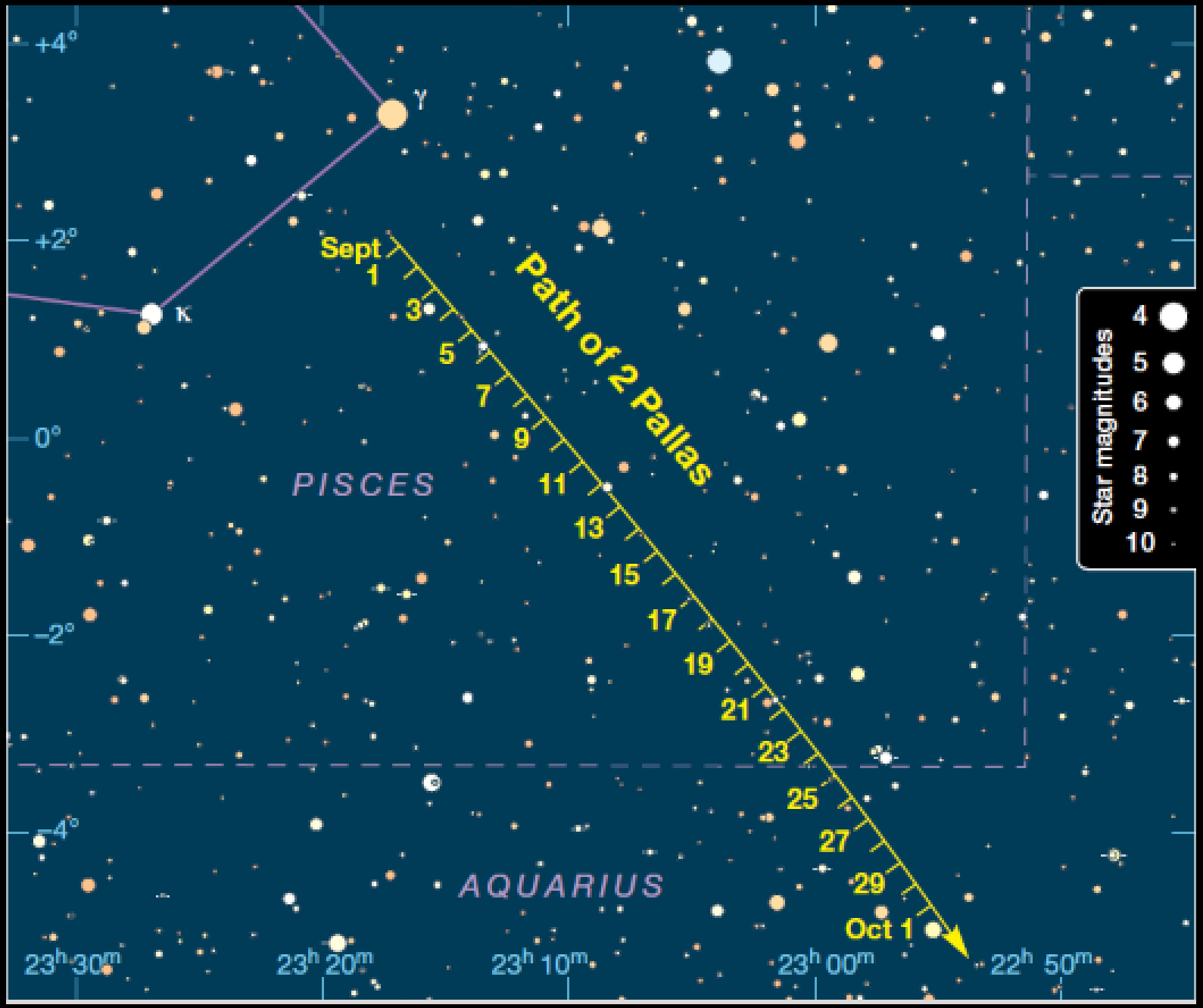
Recent & Upcoming Earth-asteroid encounters:

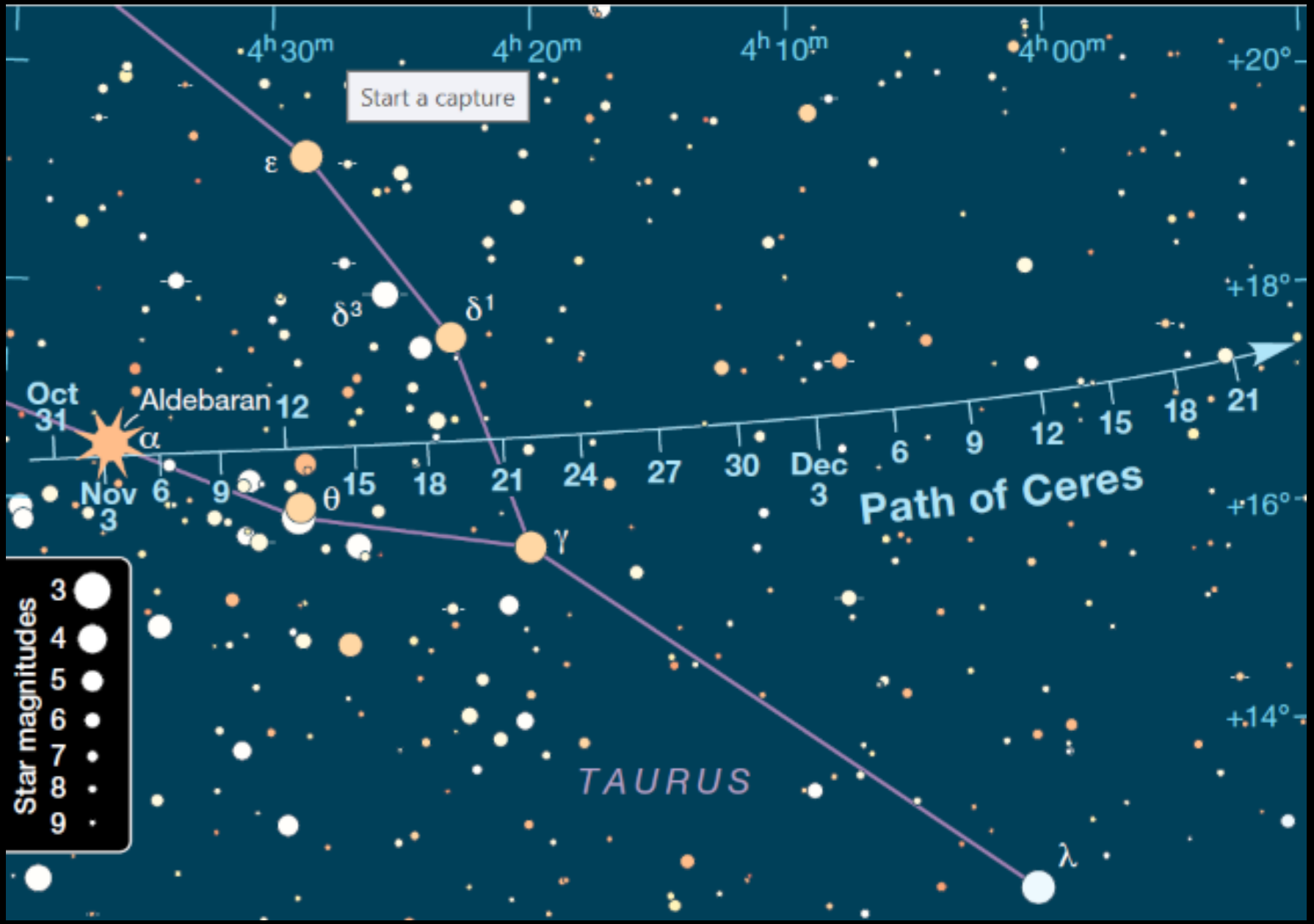
Asteroid	Date(UT)	Miss Distance	Velocity (km/s)	Diameter (m)
2021 TP8	2021-Oct-14	4.4 LD	12.2	10
2021 TS3	2021-Oct-14	10.9 LD	4.2	13
2021 TC1	2021-Oct-14	14.6 LD	6.6	31
2021 SM1	2021-Oct-14	6.9 LD	7.2	27
2021 TT4	2021-Oct-14	5.1 LD	3.1	9
2021 TN6	2021-Oct-14	10 LD	19.8	33
2021 SM3	2021-Oct-15	13 LD	15.8	96
2021 TU9	2021-Oct-15	15 LD	8.8	25
2021 TK10	2021-Oct-15	5.9 LD	9.8	12
2020 TH6	2021-Oct-19	7.3 LD	5.9	6
2021 TX2	2021-Oct-19	9 LD	10.7	33
1996 VB3	2021-Oct-20	8.8 LD	15.3	135
2021 TV3	2021-Oct-21	13.3 LD	12.8	47
2021 TE4	2021-Oct-21	8.3 LD	6	15
2021 SG2	2021-Oct-21	15.9 LD	5.9	25
2021 RE10	2021-Oct-21	15.5 LD	5.1	56
2021 TE1	2021-Oct-23	9.5 LD	12.5	47
2017 SJ20	2021-Oct-25	18.7 LD	15.7	120
2019 UW6	2021-Oct-26	8 LD	11.1	17
2009 WY7	2021-Nov-02	19.2 LD	14.7	54
2017 TS3	2021-Nov-02	13.9 LD	9.9	131
2005 VL1	2021-Nov-04	17 LD	5.2	18
2020 KA	2021-Nov-06	14.9 LD	4.8	11
2021 SP3	2021-Nov-08	15.6 LD	9.3	70
2019 XS	2021-Nov-09	1.5 LD	10.7	65

Source: Spaceweathr.com

Larger asteroids

Name	Year Discovered	Diameter (mi)	Max magnitude
Ceres	1801	582	6.6
Vesta	1807	326	5.2
Pallas	1802	317	6.5
Hygiea	1849	269	9.0
Interamnia	1910	206	9.9
Europa	1858	188	
Sylvia	1866	170	
Davida	1903	167	9.5
Euphrosyne	1854	166	10.2
Juno	1804	153	7.5


+4°
+2°
0°
−2°
−4°
γ
κ
PISCES
AQUARIUS
Path of 2 Pallas
Sept 1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
Oct 1
23h 30m
23h 20m
23h 10m
23h 00m
22h 50m
Star magnitudes
4
5
6
7
8
9
10


4h 30m
4h 20m
4h 10m
4h 00m
+20°
+18°
+16°
+14°
Start a capture
ε
δ3
δ1
Oct 31
Aldebaran
α
12
Nov 3
6
9
θ
15
18
21
24
27
30
Dec 3
6
9
12
15
18
21
Path of Ceres
γ
λ
TAURUS
Star magnitudes
3
4
5
6
7
8
9


COMETS
Nature’s “dirty snowballs”

The press has yet to figure out comets . . . . . .

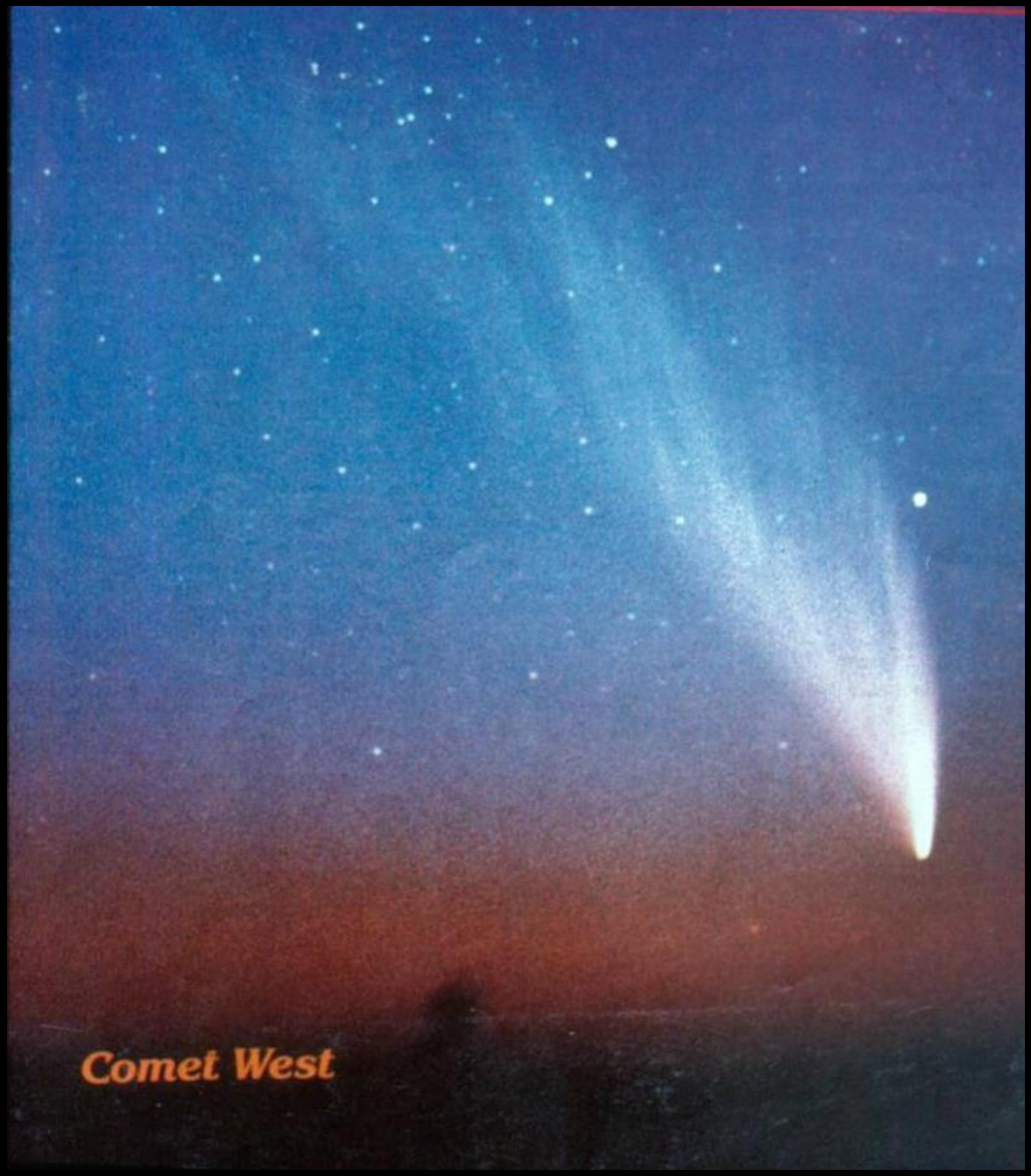
Comet Bennett, 1970 . . . . . .you didn’t hear a word about it . ..

So . . . . Comet Kohoutek, discovered in 1974

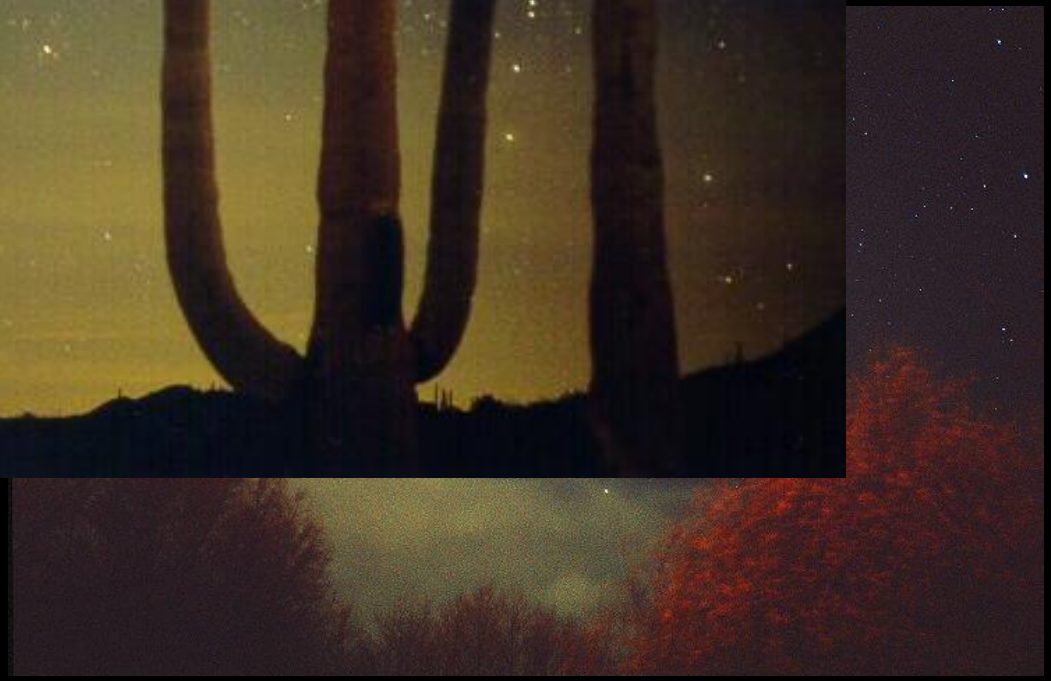
Comet of the Century!!

“You won’t fool me again” . . .

Comet West, 1976 . . . . . No press

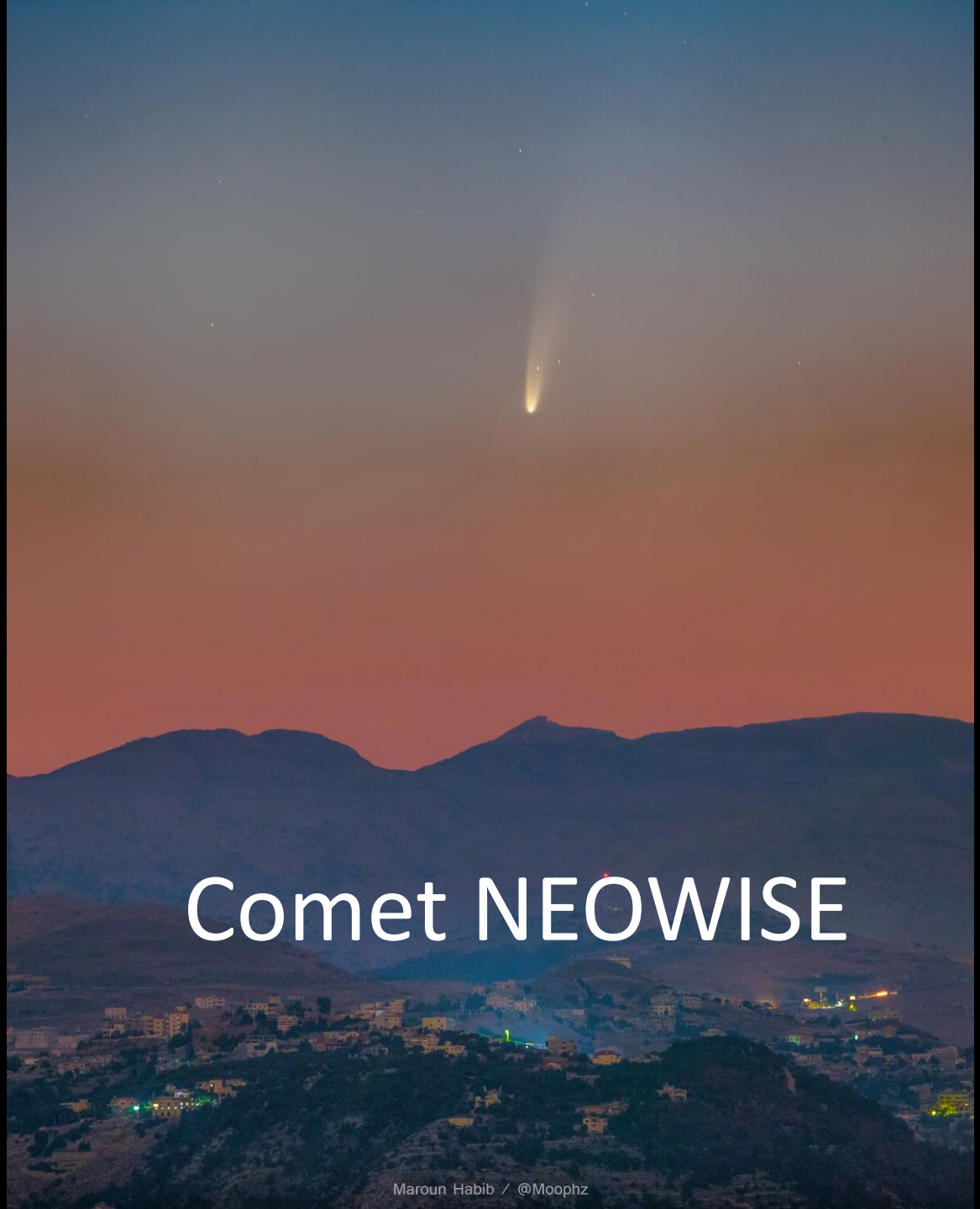

Comet West

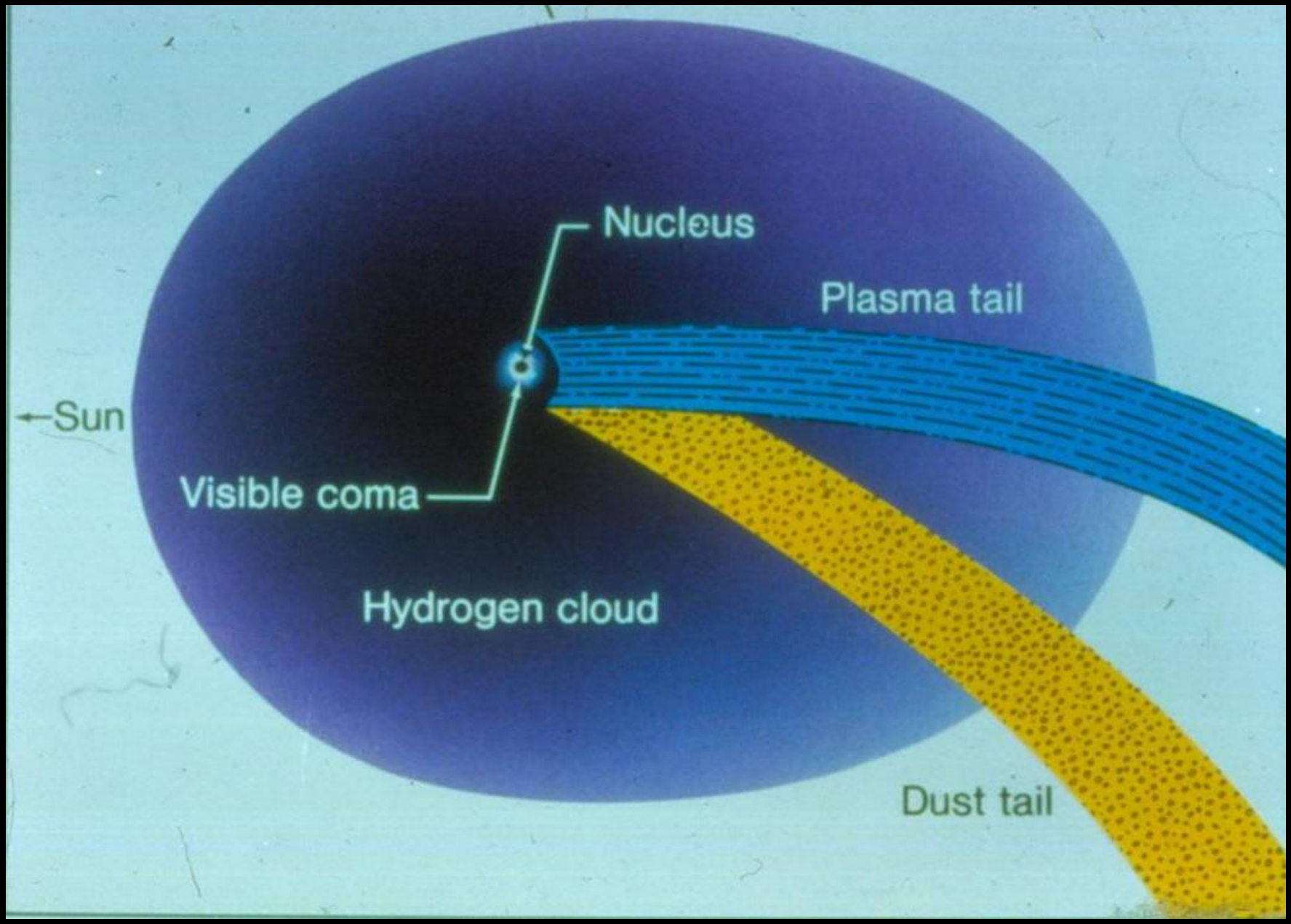
Comet Hyakutake, 1996



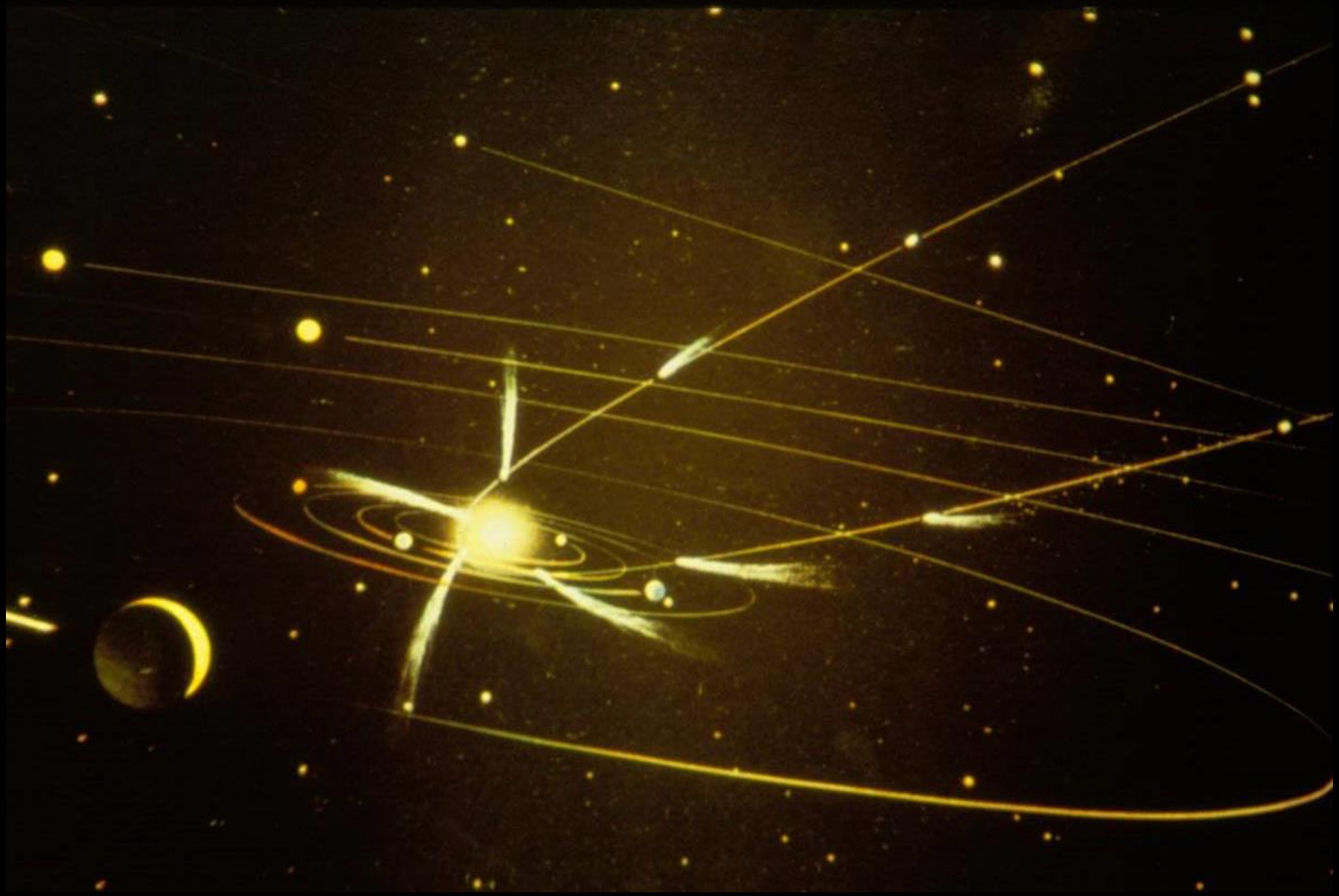
Com

Comet PanSTARRS, 2013


Comet NEOWISE
Maroun Habib / @Moophz

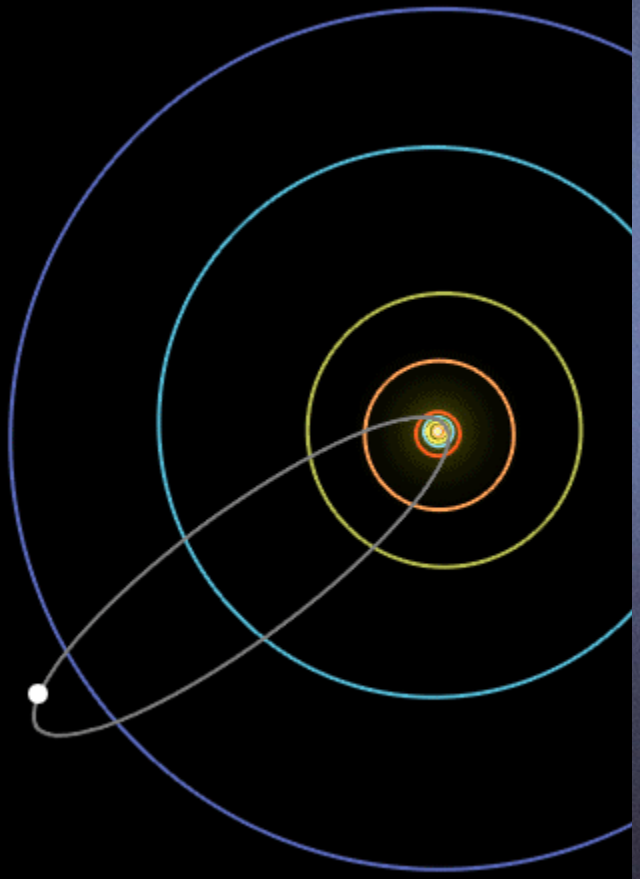

Nucleus
Plasma tail
Sun
Visible coma
Hydrogen cloud
Dust tail

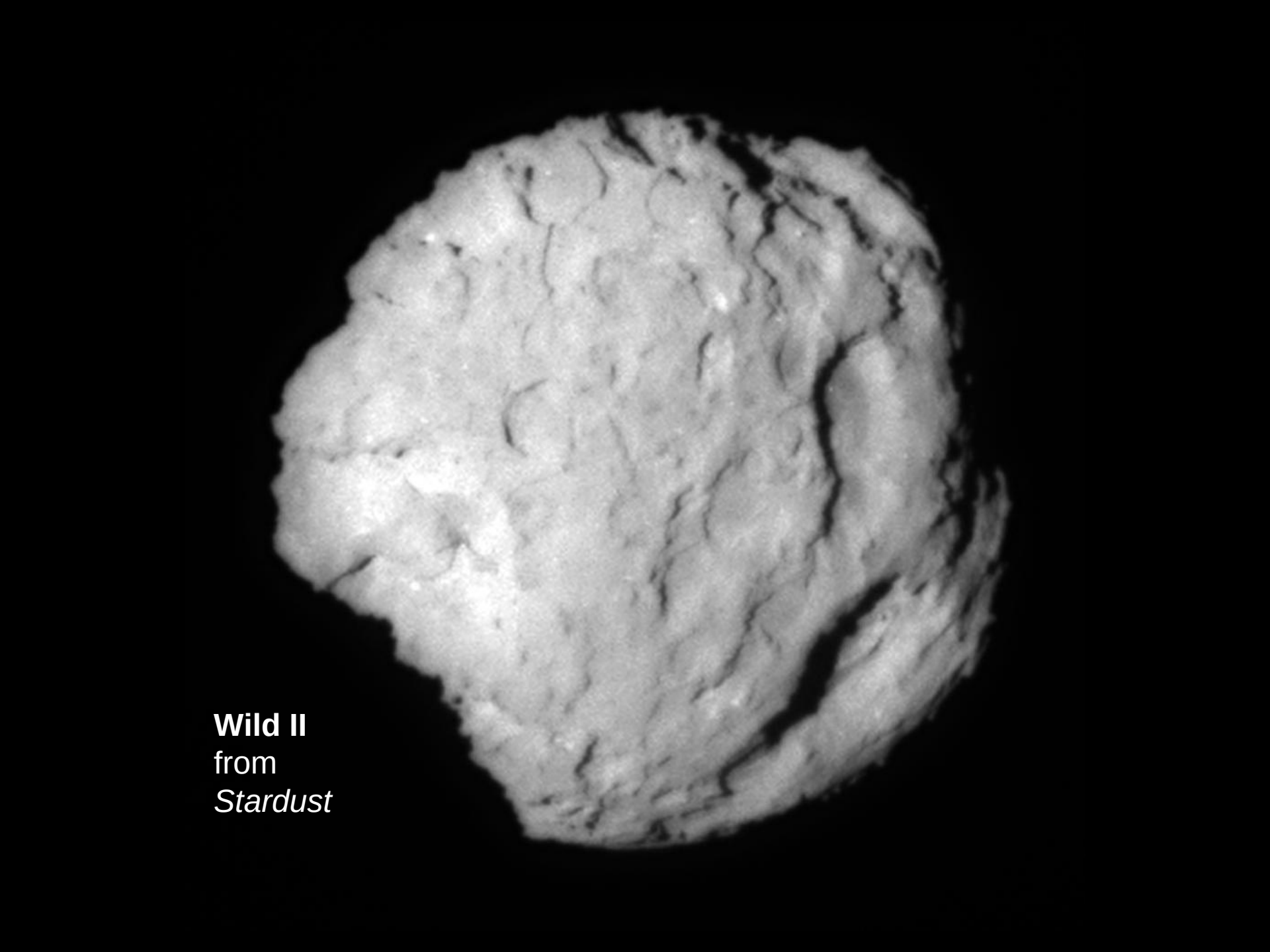

Gas Tail
Dust tail
Coma



https://www.wcia.com/morning-show-features/morning-show/whys-guys-making-a-comet/

Halley's Comet 1986





Wild II
from
Stardust

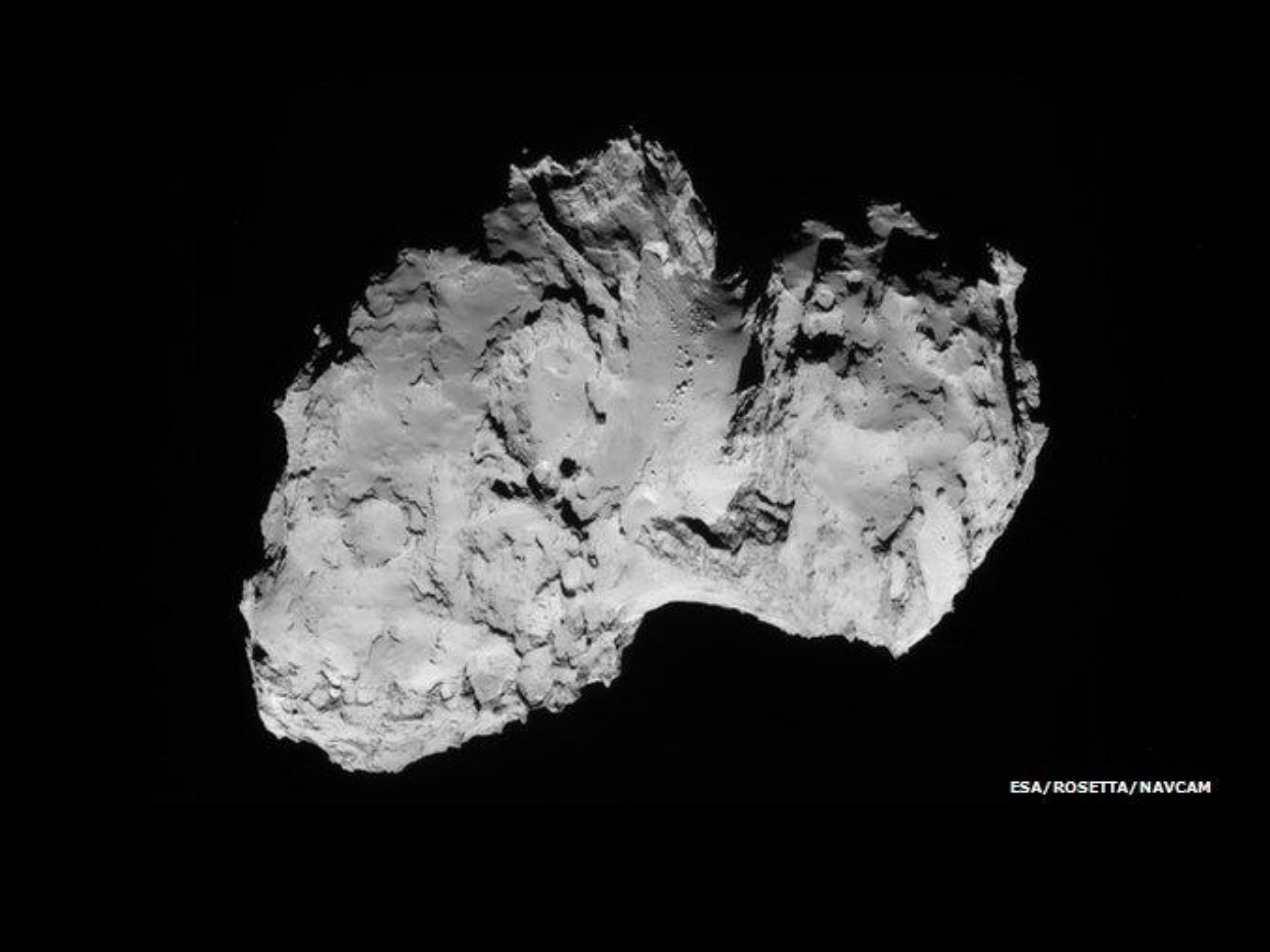
Comet Borrelly
from *Deep Space 1*

Rosetta, Fall, 2014

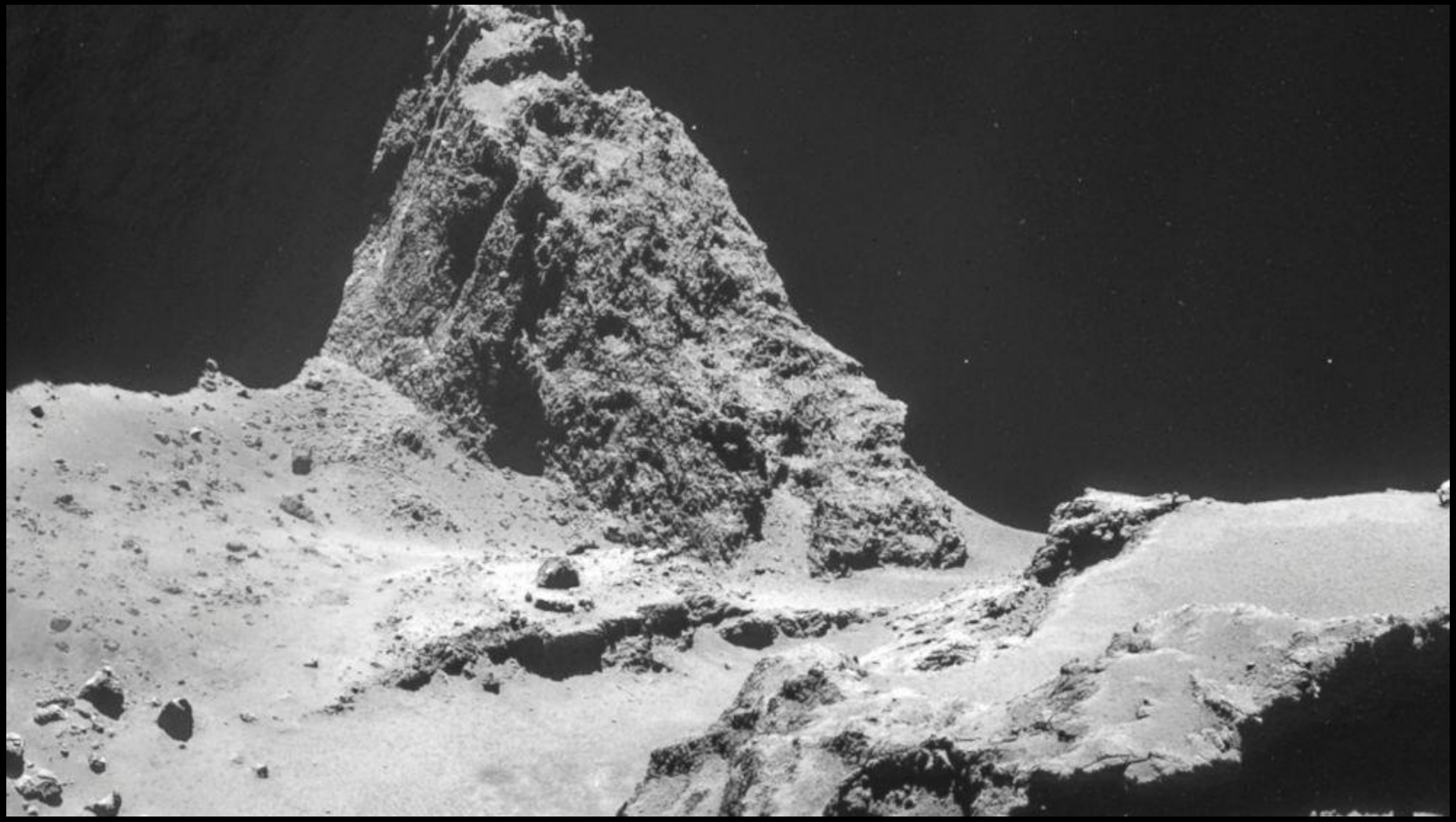
10 –year journey to Comet Churyumov–Gerasimenko

***Philae* lander**

Comet disc. 1969
About 2.5 miles across

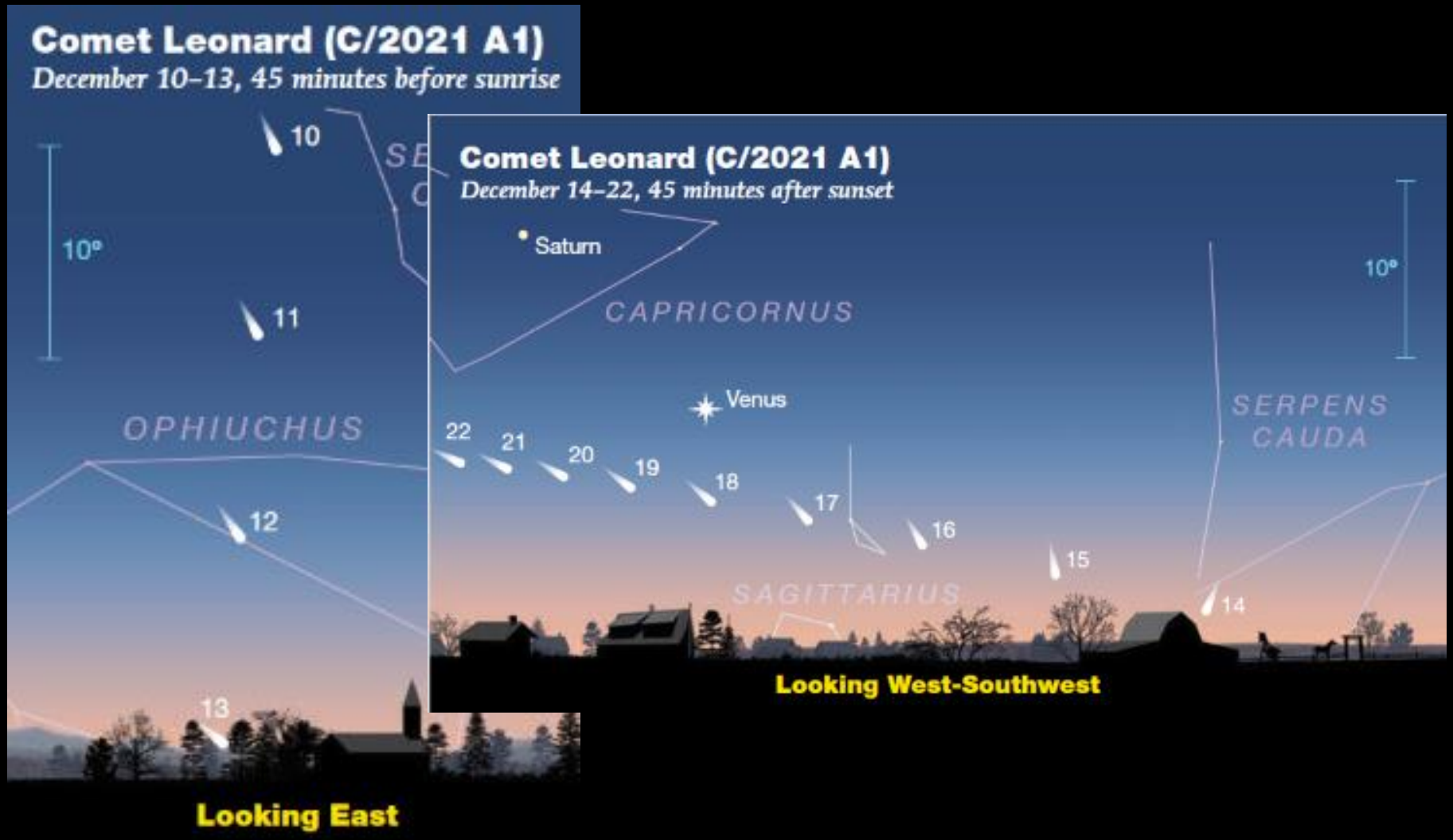

ESA/ROSETTA/NAVCAM

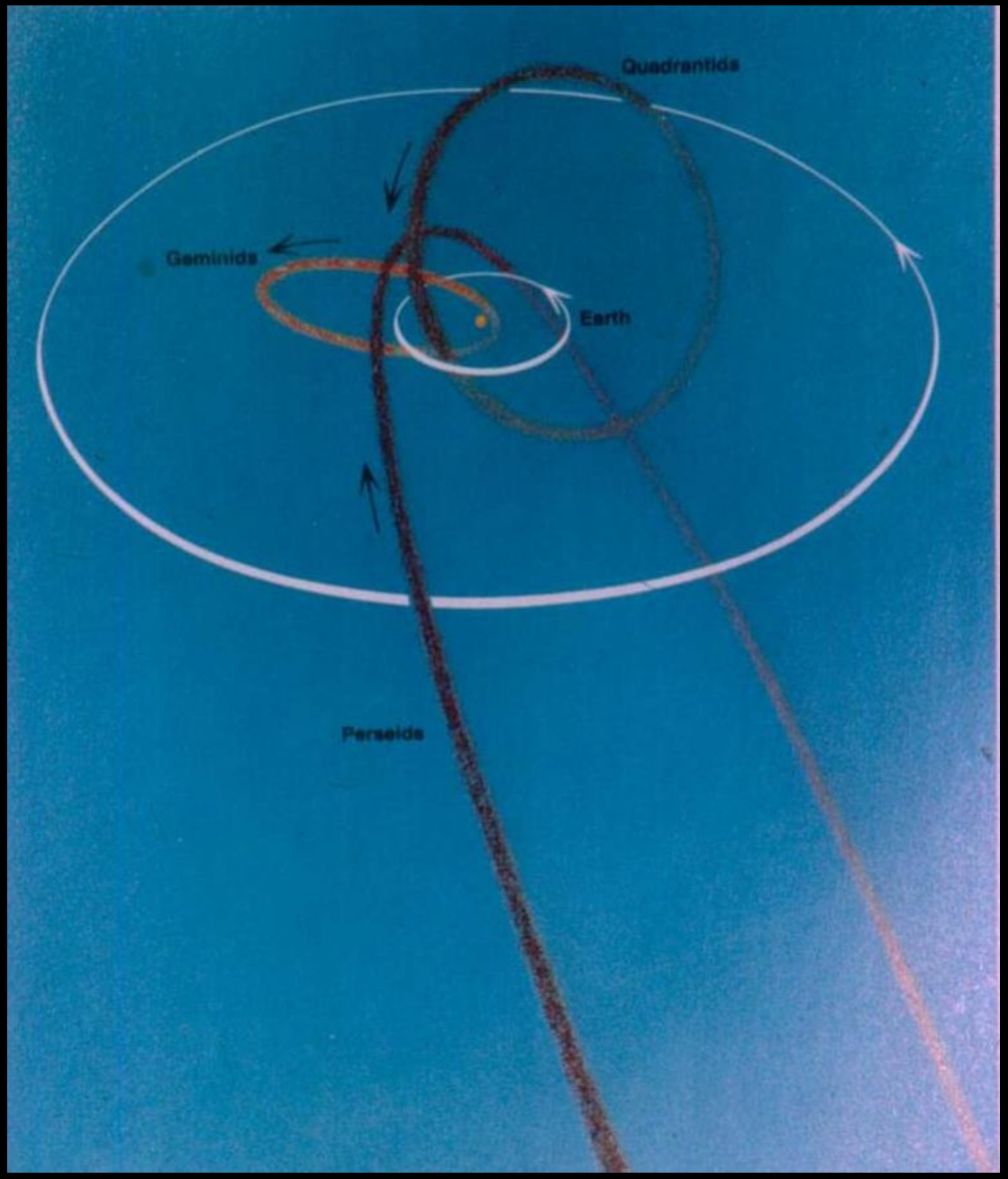
Fall, 2016



Fall, 2018

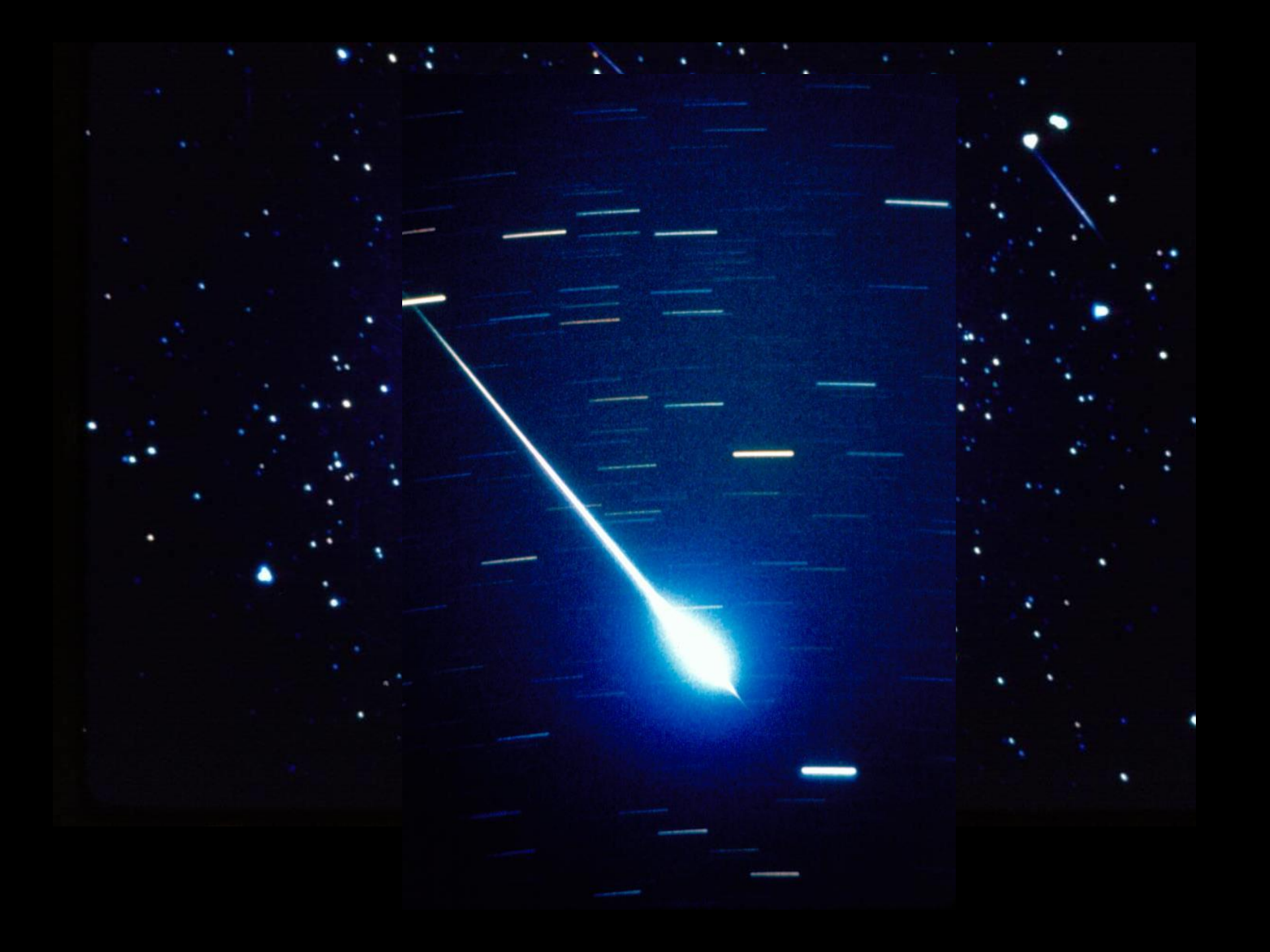
Comet Leonard



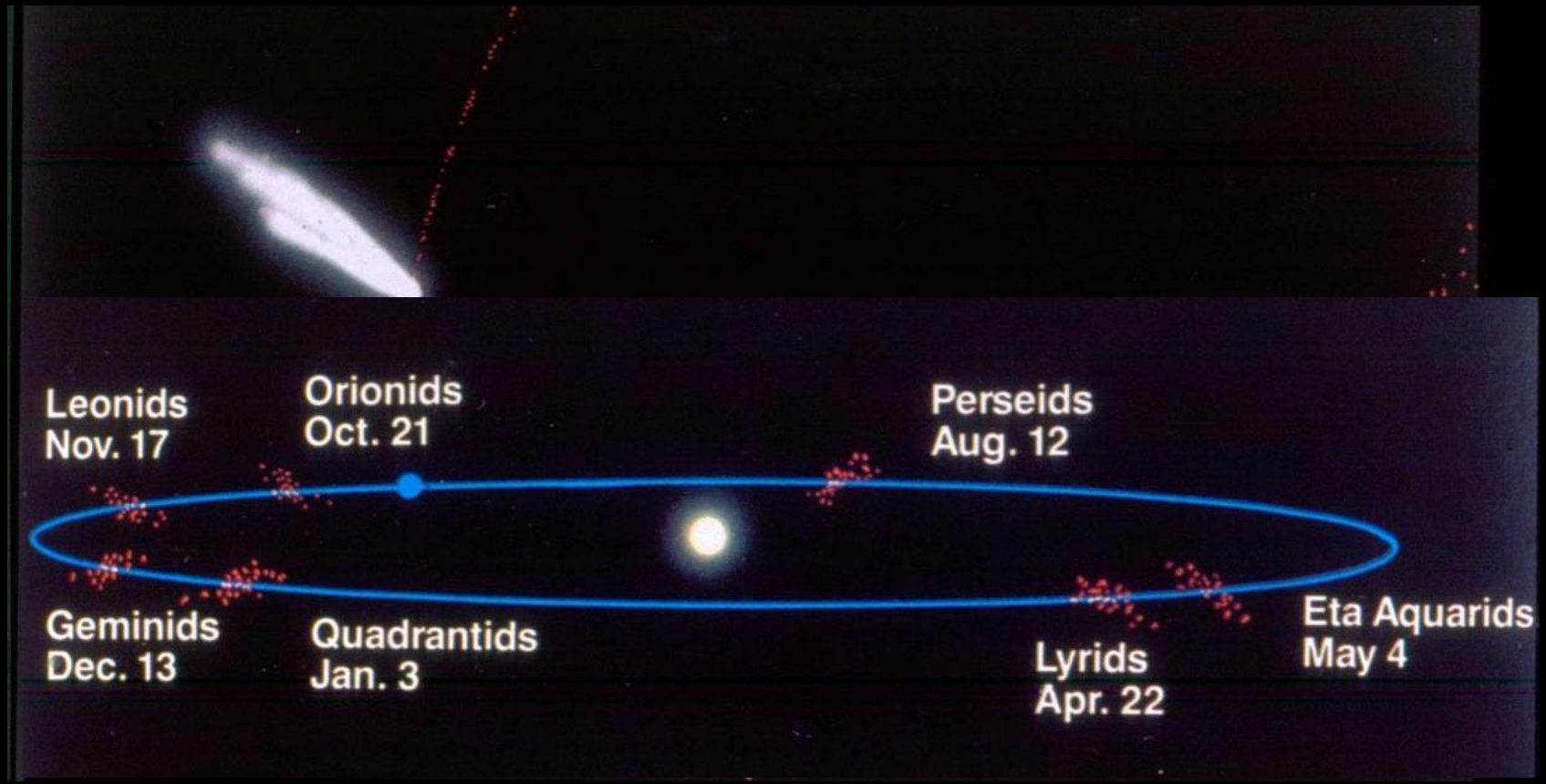


The “Hansel & Gretel” scenario

What if the Earth hits one of these comet paths?



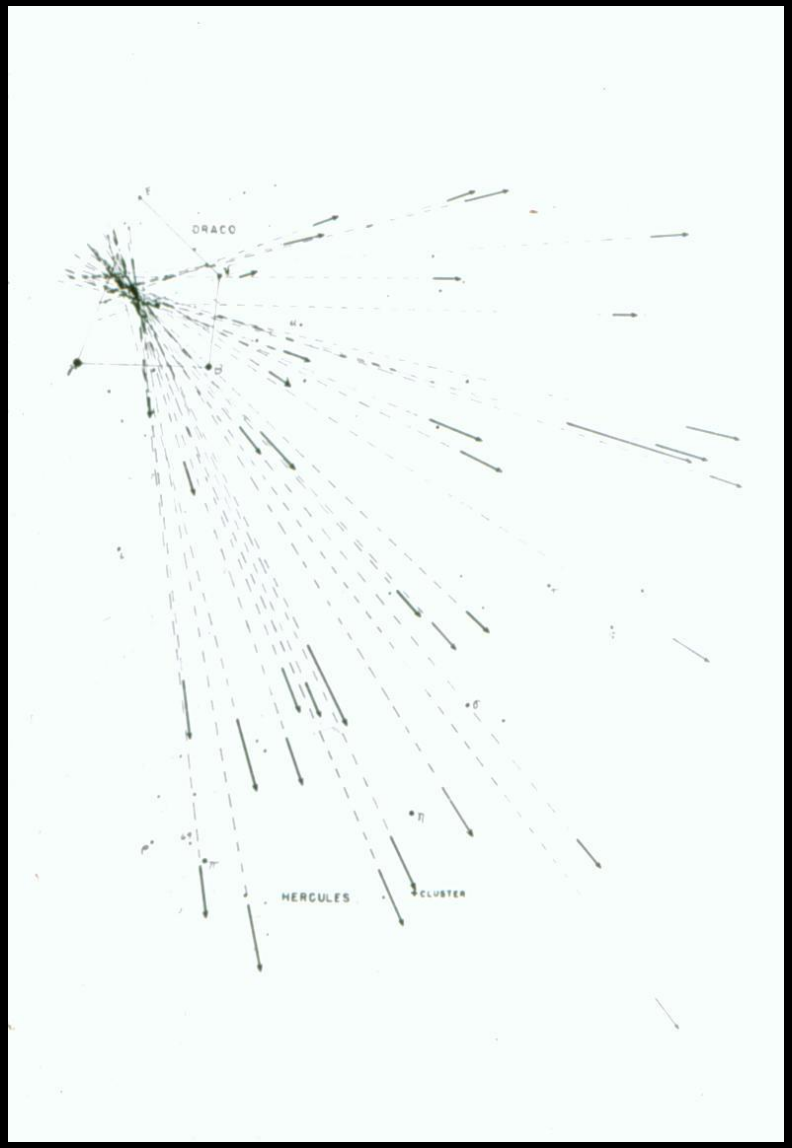

ly Pacholka / AstroPics.com


Leonids
Nov. 17
Orionids
Oct. 21
Perseids
Aug. 12
Geminids
Dec. 13
Quadrantids
Jan. 3
Lyrids
Apr. 22
Eta Aquarids
May 4

Definitions . . .

- “Meteoroid” – small bit of rock/dust in space
- “Meteor”- glowing trail seen in the sky from a meteoroid passing through our atmosphere. 110,000mph! Size of pencil eraser! 40-80 miles up
- “Meteorite” – a bit of rock (usually from the asteroid belt) that is large enough (~basketball) to actually hit the ground.

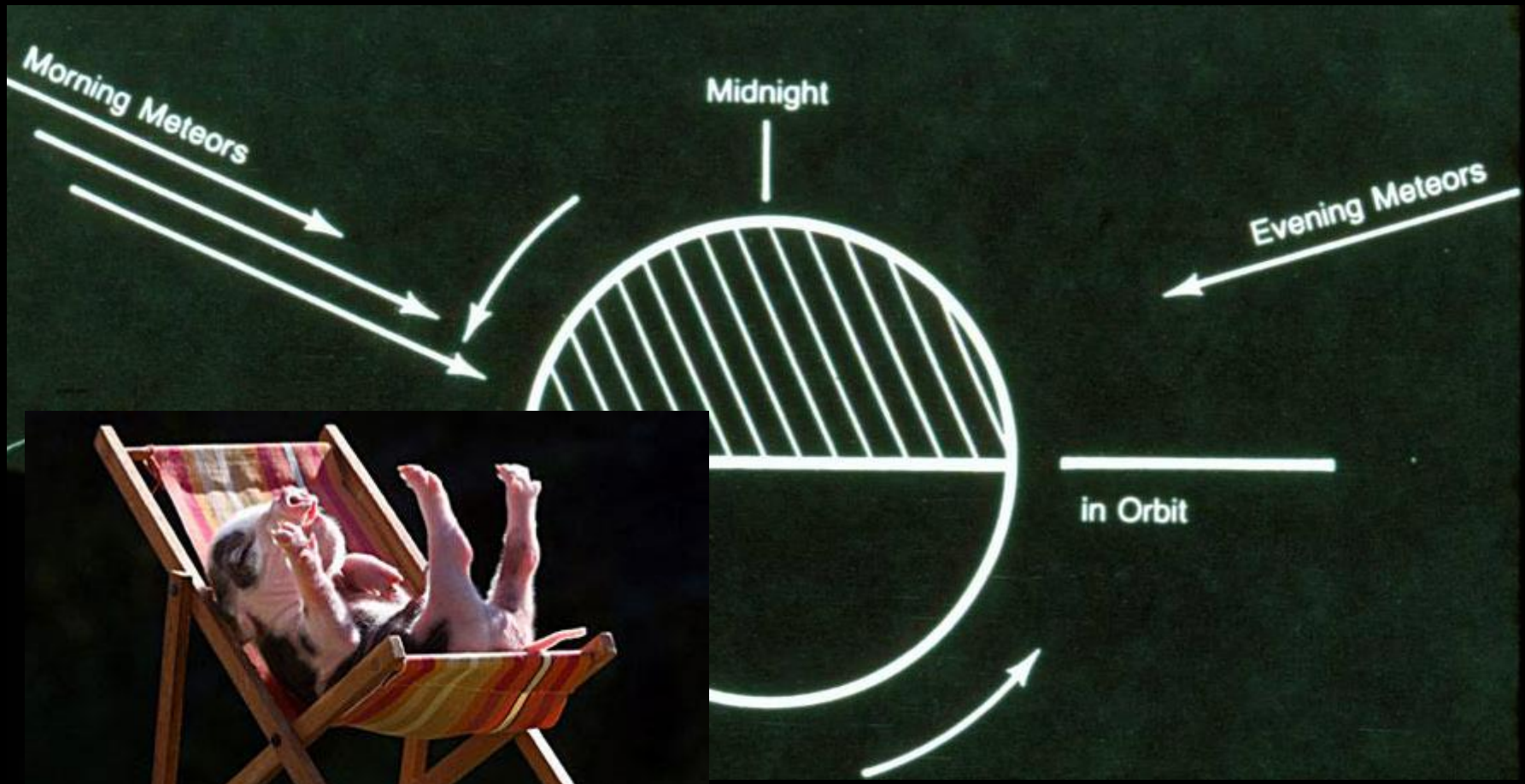
Meteor shower names



Principal Meteor Showers

SHOWER	BEST VIEWING	POINT OF ORIGIN	DATE OF MAXIMUM*	NO. PER HOUR**	ASSOCIATED COMET
Quadrantid	**Predawn**	**N**	**Jan. 4**	**25**	**—**
Lyrid	Predawn	S	Apr. 22	10	Thatcher
Eta Aquarid	Predawn	SE	May 4	10	Halley
Delta Aquarid	Predawn	S	July 30	10	—
Perseid	**Predawn**	**NE**	**Aug. 11–13**	**50**	**Swift-Tuttle**
Draconid	Late evening	NW	Oct. 9	6	Giacobini-Zinner
Orionid	Predawn	S	Oct. 21–22	15	Halley
Taurid	Late evening	S	Nov. 9	3	Encke
Leonid	Predawn	S	Nov. 17–18	10	Tempel-Tuttle
Andromedid	Late evening	S	Nov. 25–27	5	Biela
Geminid	**All night**	**NE**	**Dec. 13–14**	**75**	**—**
Ursid	Predawn	N	Dec. 22	5	Tuttle

May vary by one or two days* ***Moonless, rural sky* **Bold = *most prominent*


Morning Meteors
Midnight
Evening Meteors
in Orbit

Geminids – Dec. 13 am