An Introduction to

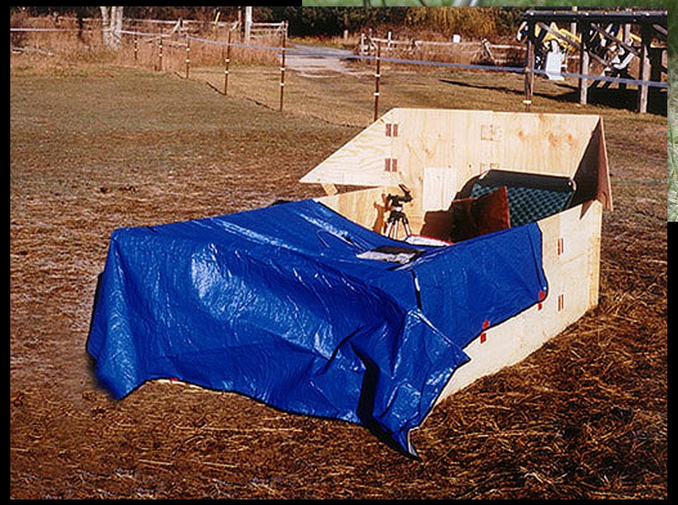
METEORS, METEOR SHOWERS AND METEORITES

By Pierre Martin

PIERRE MARTIN PHOTOGRAPHY

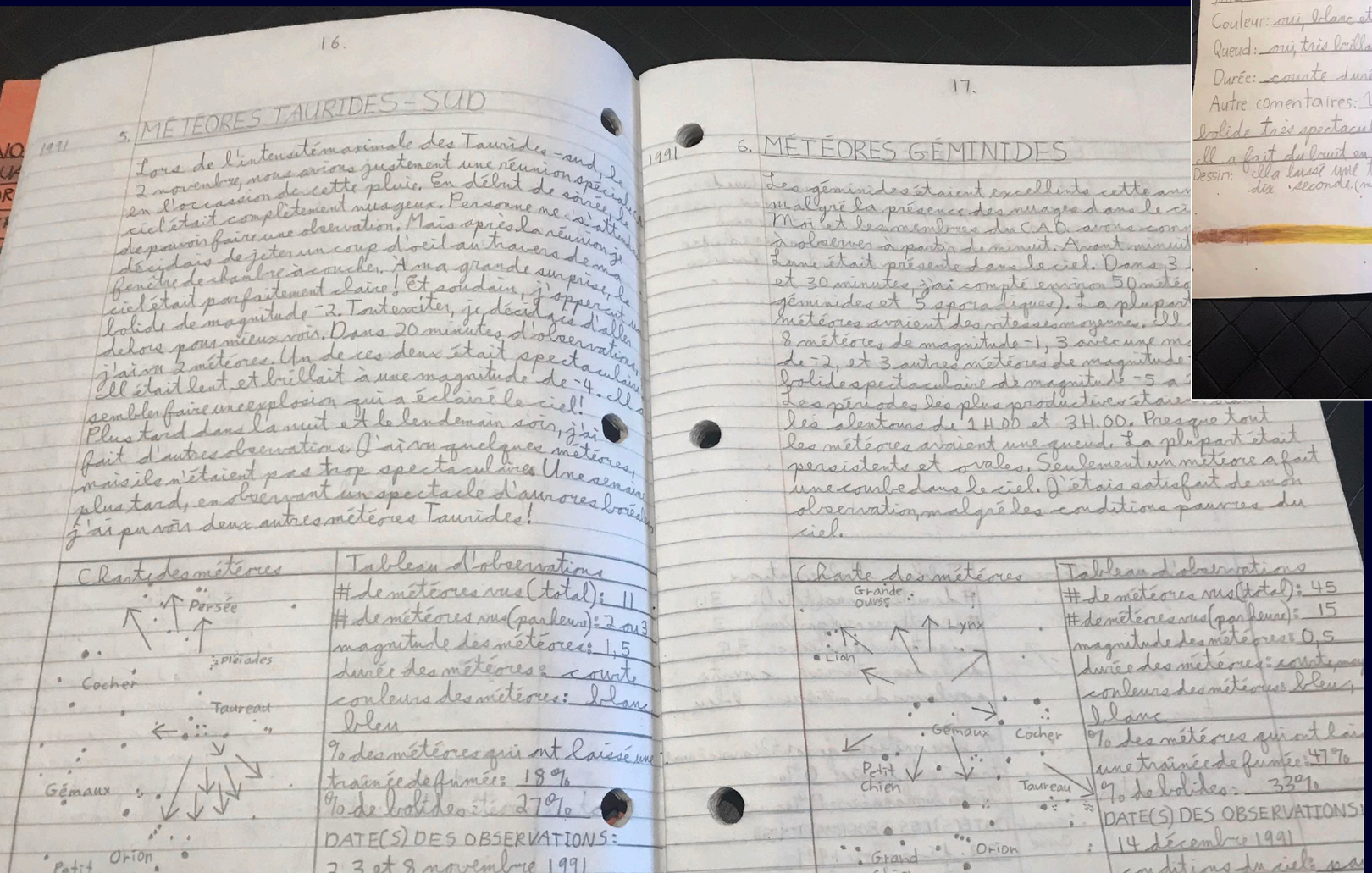
Photo by Pierre Martin

ABOUT ME



Photos by Pierre Martin

My passion and early efforts (12-13 years old)


16.

1991 5. MÉTÉORES TAURIDES - SUD

Lors de l'intensité maximale des Taurides - sud, le 2 novembre, nous avions justement une réunion spéciale en l'occasion de cette pluie. En début de soirée, le ciel était complètement nuageux. Personne ne s'attendait de pouvoir faire une observation. Mais après la réunion je décidais de jeter un coup d'oeil au travers de ma fenêtre de chambre à coucher. À ma grande surprise, le ciel était parfaitement claire! Et soudain, j'apperçut un bolide de magnitude -2. Tout excité, je décidais d'aller dehors pour mieux voir. Dans 20 minutes d'observation, j'ai vu 2 météores. Un de ces deux était spectaculaire. Il était lent et brillait à une magnitude de -4. Il a semblé faire une explosion qui a éclairé le ciel!
Plus tard dans la nuit et le lendemain soir, j'ai fait d'autres observations. J'ai vu quelques météores mais ils n'étaient pas trop spectaculaires. Une semaine plus tard, en observant un spectacle d'aurores boréales j'ai pu voir deux autres météores Taurides!

Chart des météores

Tableau d'observations

de météores vus (total): 11
de météores vus (par heure): 2 ou 3
magnitude des météores: 1,5
durée des météores: courte
couleurs des météores: blanc bleu
% des météores qui ont laissé une traînée de fumée: 18%
% de bolides: 27%
DATE(S) DES OBSERVATIONS: 2, 3 et 8 novembre 1991

17.

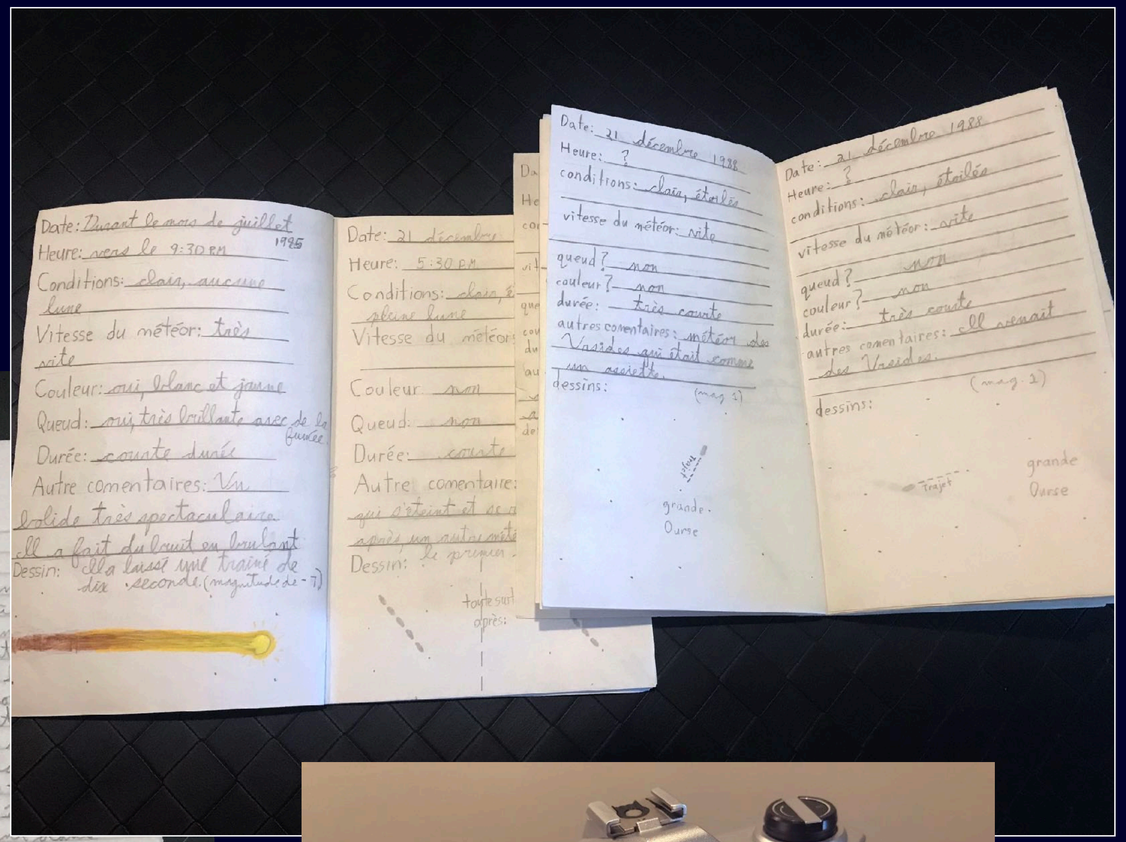
1991 6. MÉTÉORES GÉMINIDES

Les géminides étaient excellents cette année malgré la présence des nuages dans le ciel. Moi et les membres du C.A.B. avons convenu à observer à partir de minuit. Avant minuit la lune était présente dans le ciel. Dans 3 heures et 30 minutes, j'ai compté environ 50 météores (géminides et 5 sporadiques). La plupart des météores avaient des vitesses moyennes. Il y a eu 8 météores de magnitude -1, 3 avec une magnitude de -2, et 3 autres météores de magnitude -3. Un bolide spectaculaire de magnitude -5 a été vu. Les périodes les plus productives étaient entre les alentours de 1 H 00 et 3 H 00. Presque tout les météores avaient une queue. La plupart était persistents et ovales. Seulement un météore a fait une courbe dans le ciel. J'étais satisfait de mon observation, malgré les conditions pauvres du ciel.

Chart des météores

Tableau d'observations

de météores vus (total): 45
de météores vus (par heure): 15
magnitude des météores: 0,5
durée des météores: courte
couleurs des météores: bleu, blanc
% des météores qui ont laissé une traînée de fumée: 47%
% de bolides: 33%
DATE(S) DES OBSERVATIONS: 14 décembre 1991



Photos by Pierre Martin

WHY DO I LIKE THIS?


Photo by Pierre Martin

My interest in photography — capturing meteors

Photos by Pierre Martin

https://pmartin.smugmug.com/Astronomy

Other transient events

2017 Total Solar Eclipse in Idaho

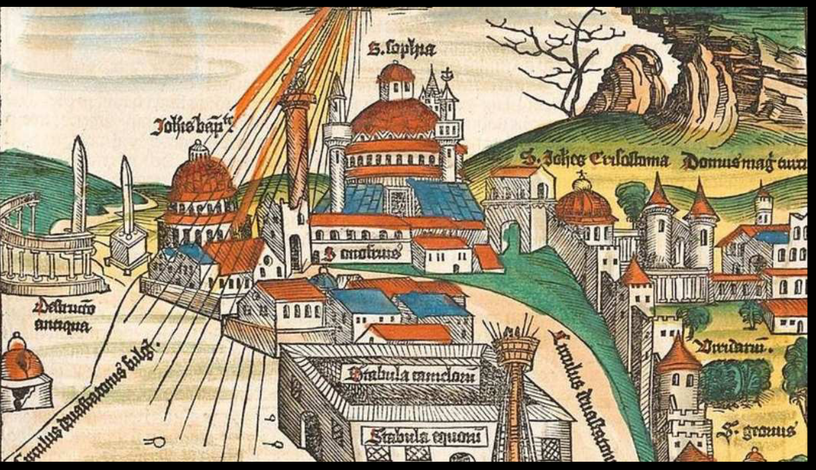
Photos by Pierre Martin

https://pmartin.smugmug.com/Astronomy/August-21-2017-Total-Solar-Eclipse-Idaho-USA/i-x3bb2pm/A

A BRIEF METEORIC HISTORY

- Meteors and comets have been observed and noted into literature for thousands of years.
- 1492 Meteorite Impact Was Interpreted as an Omen from God
- Meteors once thought to be related to atmospheric weather phenomena (i.e. METEORology) up until 19th century. Based on the ancient Greek word *meteoron*, meaning “in the sky”.
- Poorly understood (transient nature and elusiveness).
- Scientists didn't believe in meteorites until 1803.

Great Comet of 1577
(Woodcut by Jiri Daschitzsky)



1492 Ensisheim meteorite

The Great Meteor
of 1783

The Great Leonids Storm of 1833

- Frightened and amazed onlookers in the pre-dawn sky over North America.
- Several meteors every second (up to 15,000/hr)!
- Astronomers soon recognized meteors for what they really are, having a cosmic origin, due to the fixed movement of the radiant with the stars.
- **Spawned the beginning of modern meteor science and serious observations.**

METEORIC SHOWER AS SEEN AT NIAGARA FALLS.

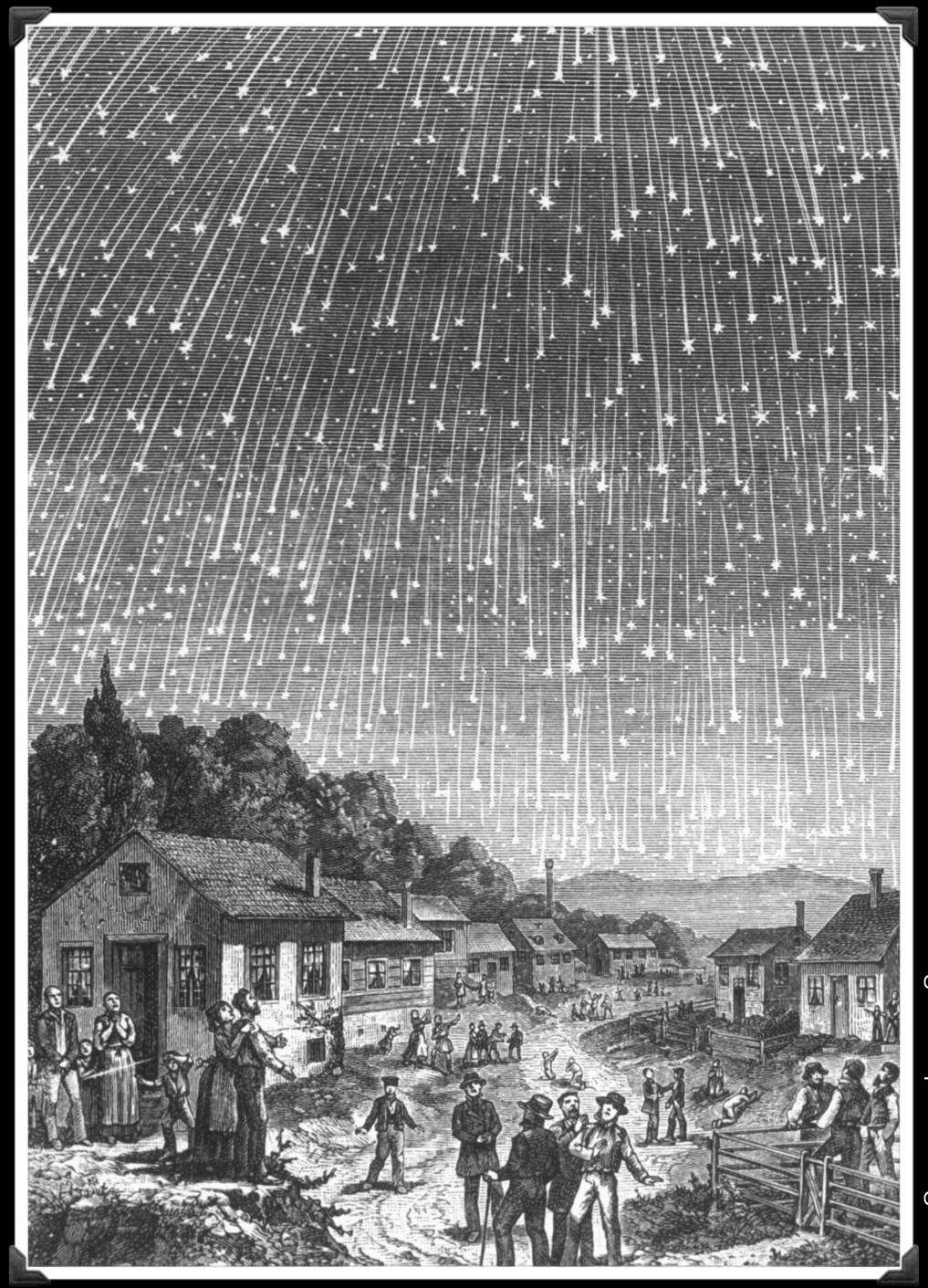
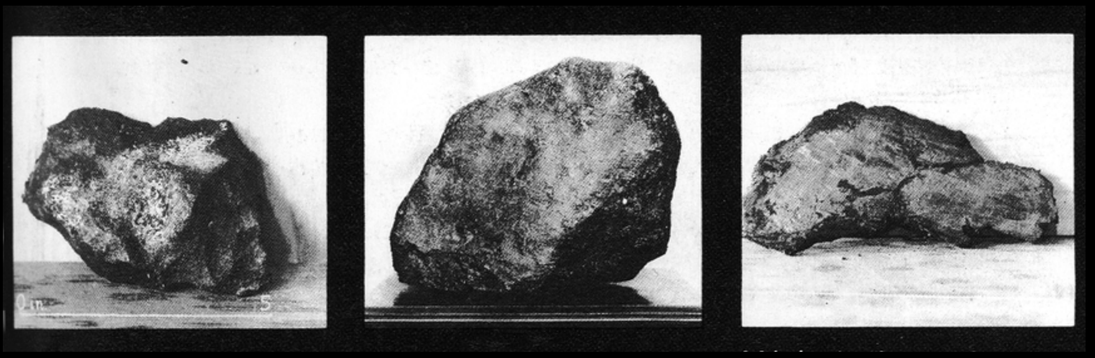


Image: sdapillars.org

A FEW BASICS:

Meteoroids vs meteors vs meteorites… what's the difference?



Stone meteorite **Iron meteorite** **Stony-Iron meteorite**

Images: C. Wimmer/Guide du Ciel

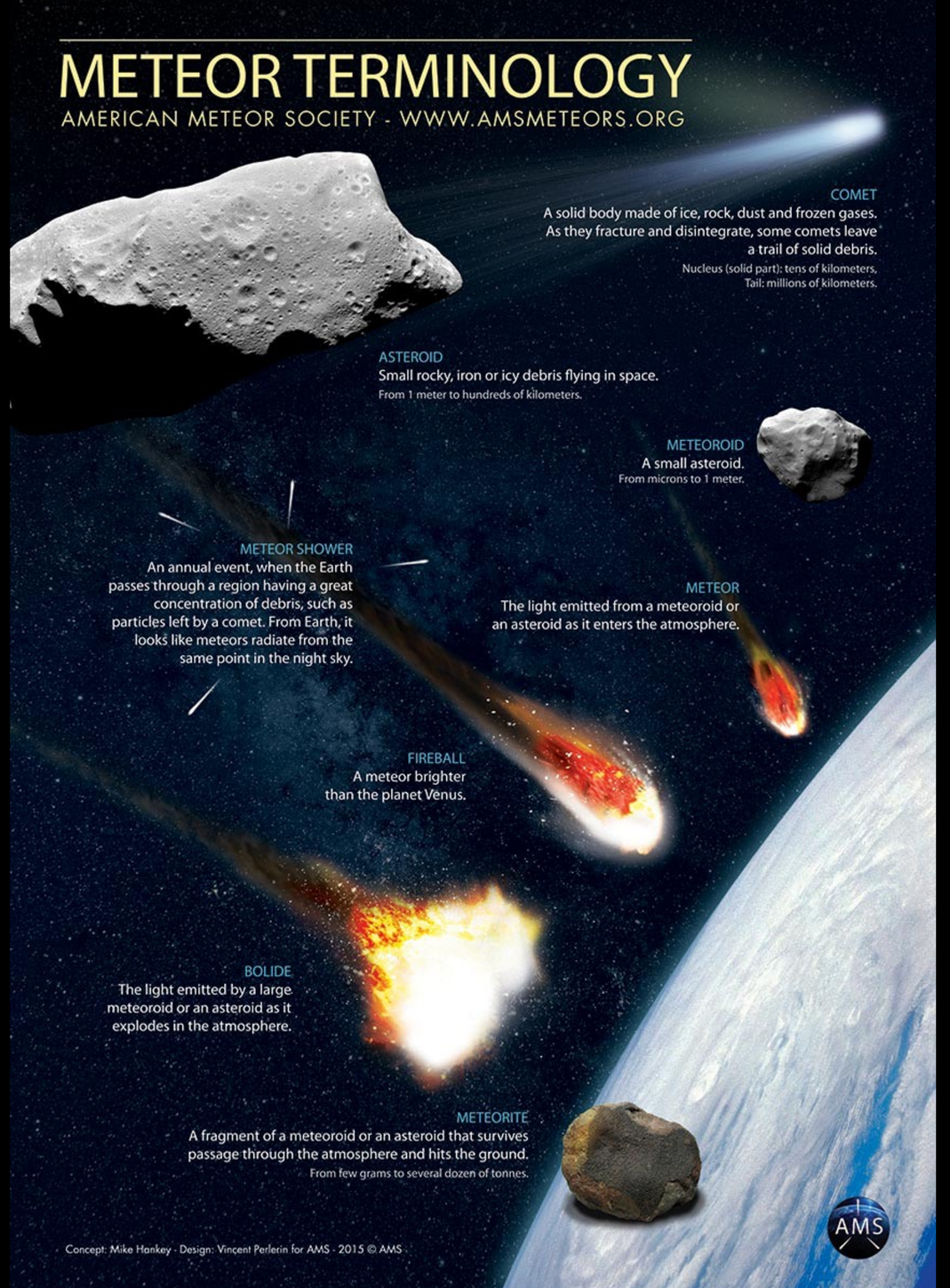


Image: American Meteor Society

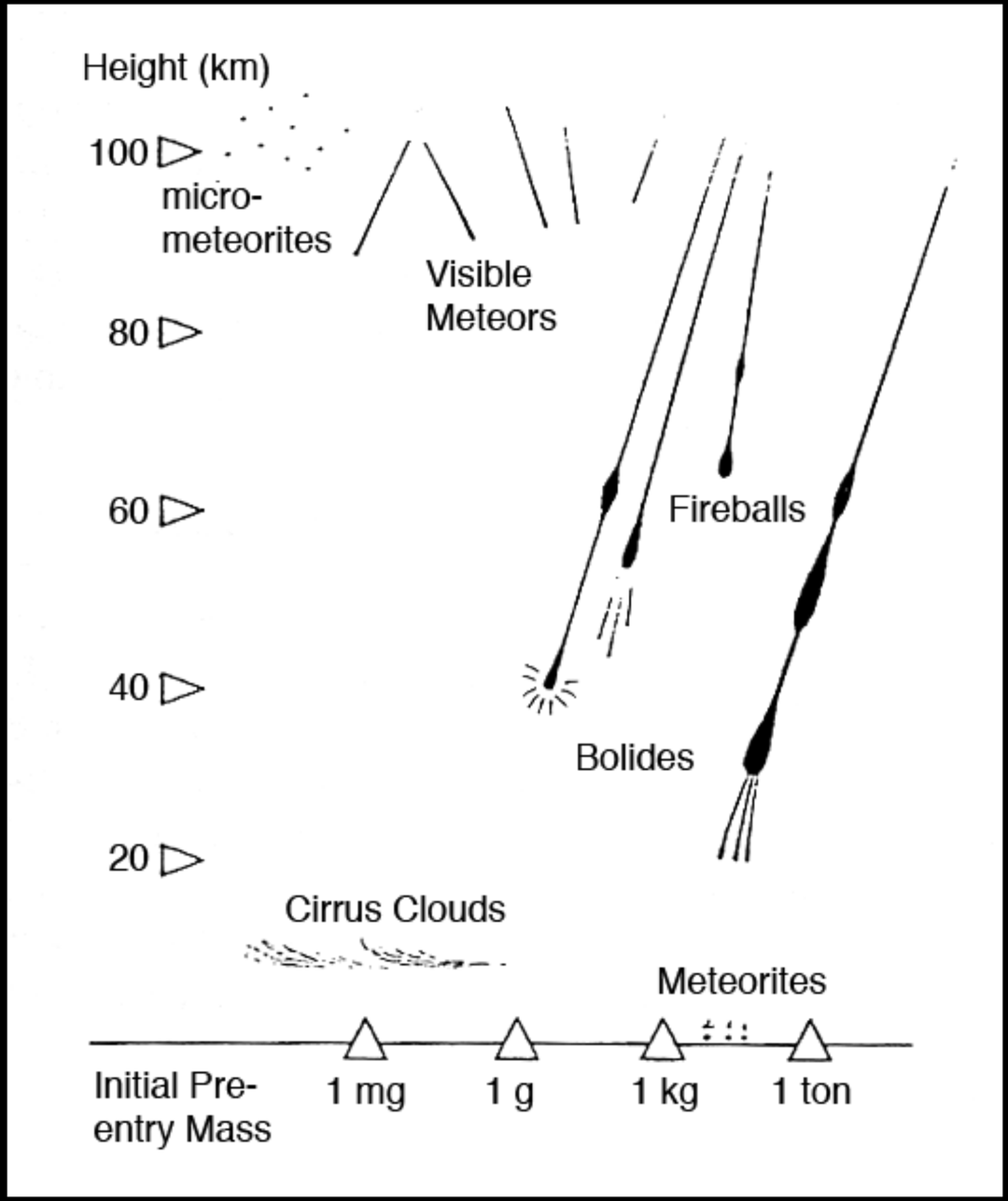


Image: Guide du Ciel

Meteor Trails: Two types

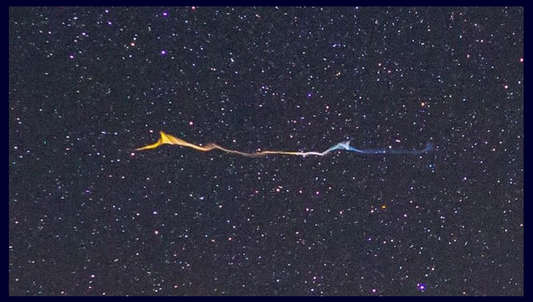


Photo: Alex Conu

First type: Persistent Train

- Glowing column of ionized and excited air molecules left behind after the meteor (like the afterglow of a neon sign).
- Most last only a few seconds, but on rare occasions, may last up to several minutes.
- Can often be seen to change shape over time due to upper atmospheric winds.
- Occur very high in the meteoric region of the atmosphere (80+ km high).

Photo: AP Photo/Chelyabinsk.ru

Second type: Smoke trail

- More often seen in daylight fireballs than at night.
- Generally occurring below 80 km of altitude.
- Non-luminous trail of debris.
- Appear similar to contrails left behind by aircraft.

Persistent train from a fireball

https://pmartin.smugmug.com/Astronomy/20160104-Quadrantids-Otter-Lake-QC/i-m3xQgwH/A

Image by Pierre Martin

Chelyabinsk Superbolide (Russia) 15 Feb 2013

https://www.youtube.com/watch?v=BEptPr0jVxw

Chelyabinsk Superbolide (Russia) 15 Feb 2013

Sonic Booms

https://www.youtube.com/watch?v=QvnrGzo8IjI

Video: YouTube / ctrlAG

Triangulation method for determining fireball path, position, angle and even its pre-entry orbit.

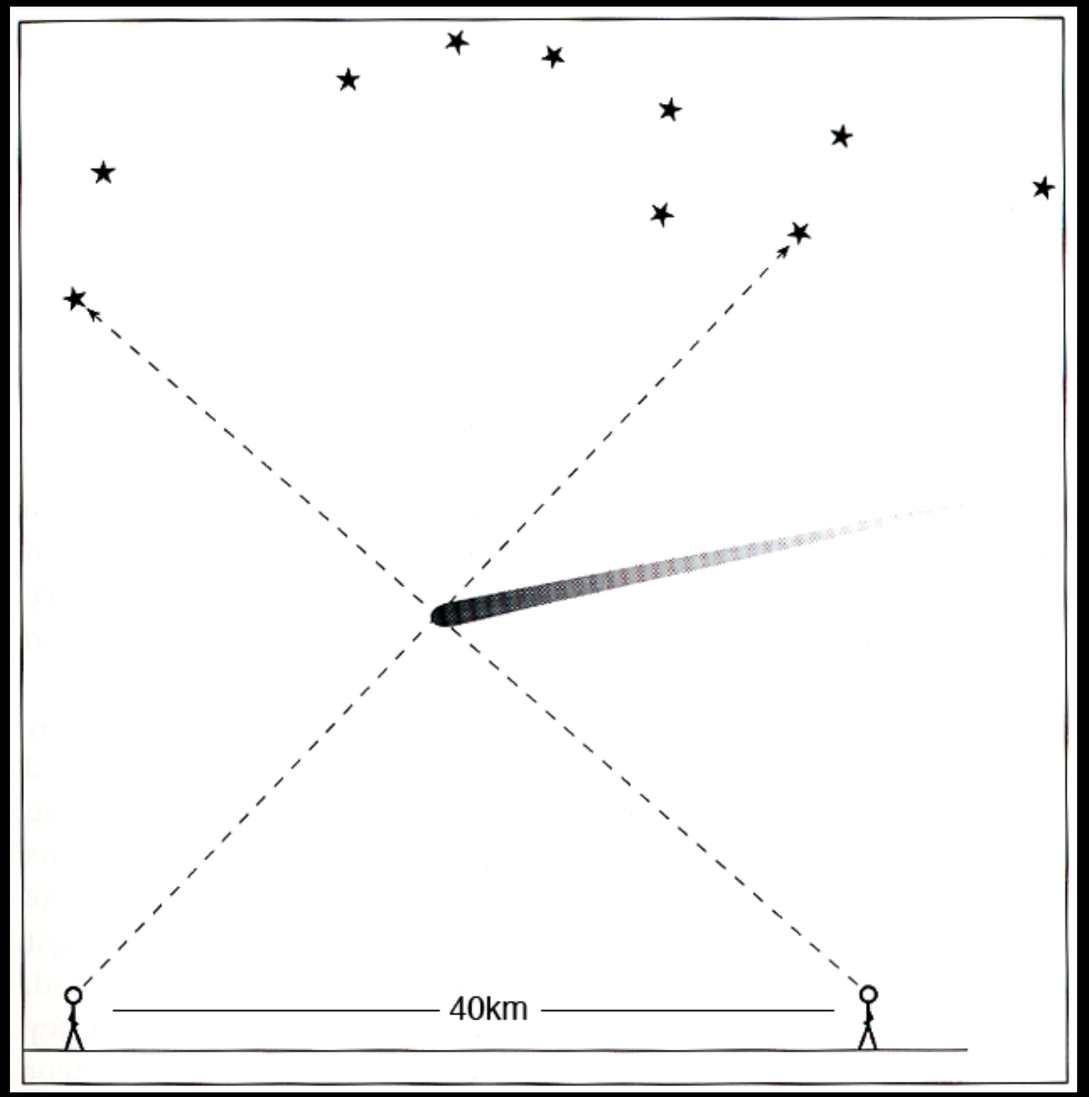
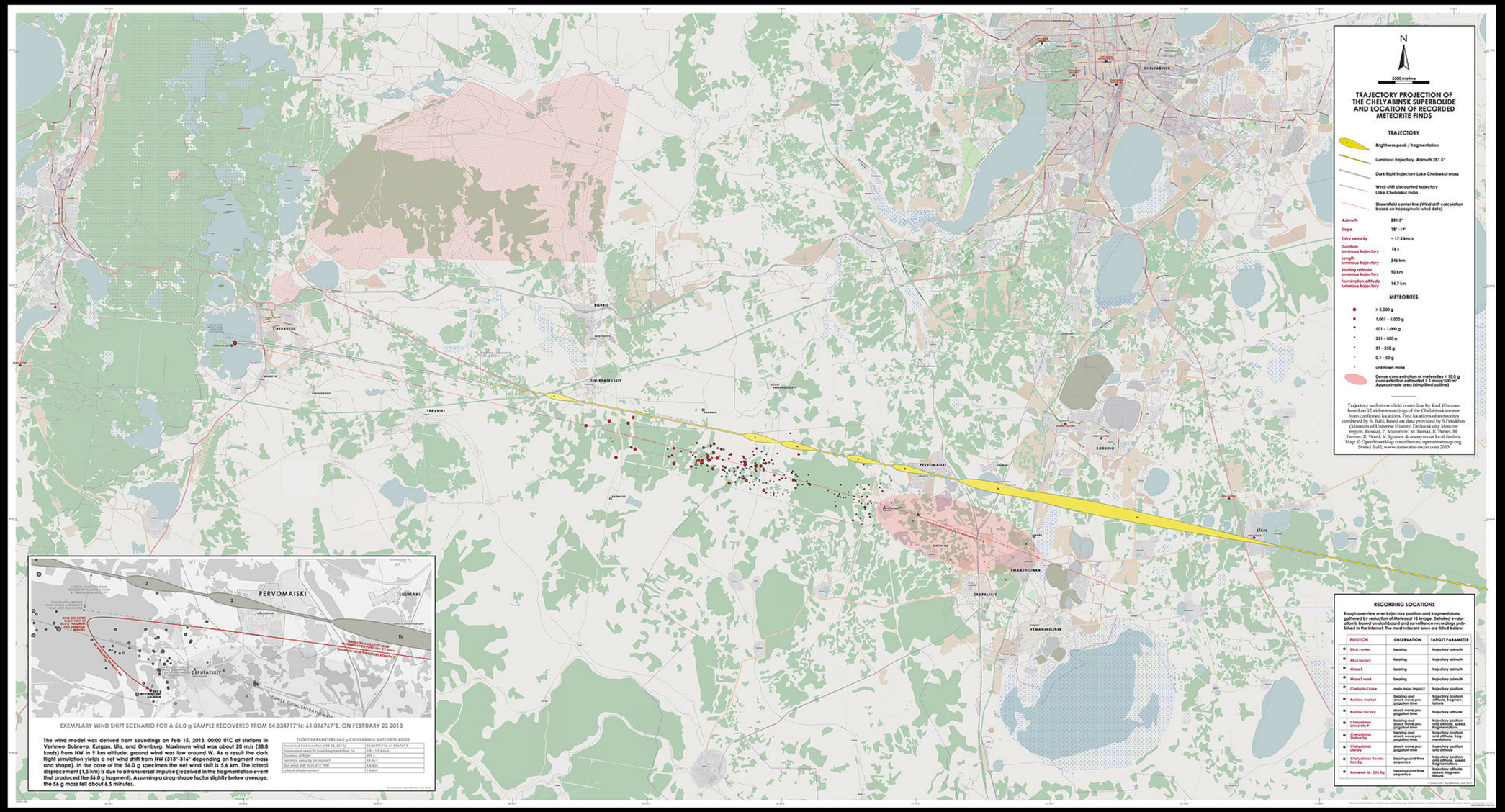


Illustration: Neil Bone / METEORS

Chelyabinsk Superbolide (Russia) 15 Feb 2013



Annual meteor showers

- Increase in the normal numbers of meteors visible, at about the same time every year.
- Meteors appear to diverge from a common point in the sky (named after the constellation which they appear to emanate from).
- Associated with meteoroids ejected from comets and forming “streams” of dust in the Solar System.
- We see meteor showers of various strengths as the Earth plows through dust streams in its path around the Sun.
- Meteor showers are beautiful sights, but also important to study:
  - helps further our knowledge of the Solar System
  - predict future outbursts & protect spacecrafts
  - detection of potentially hazardous NEOs

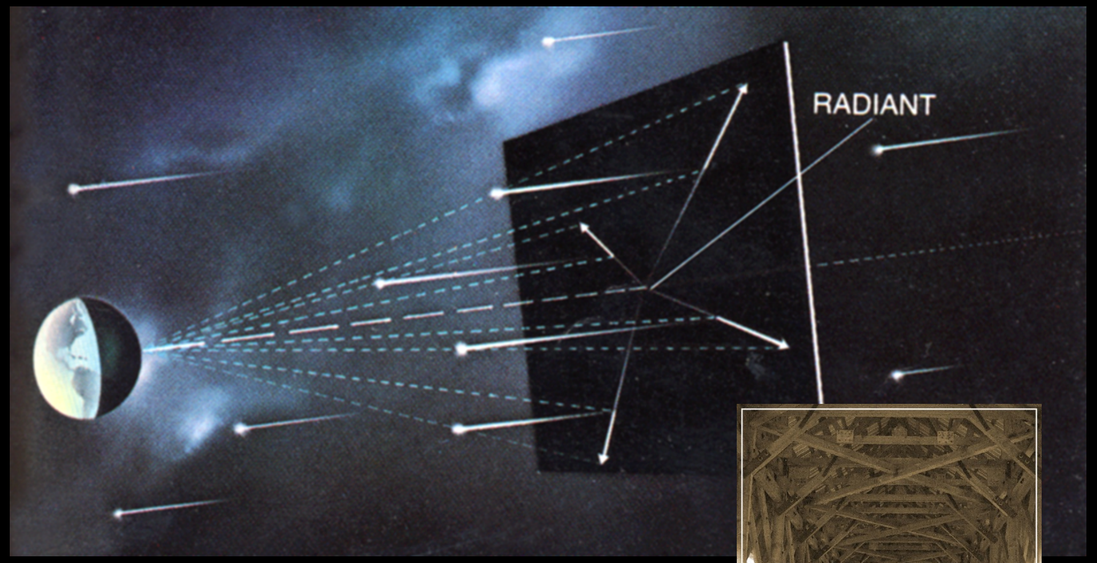


Image: Guide du Ciel

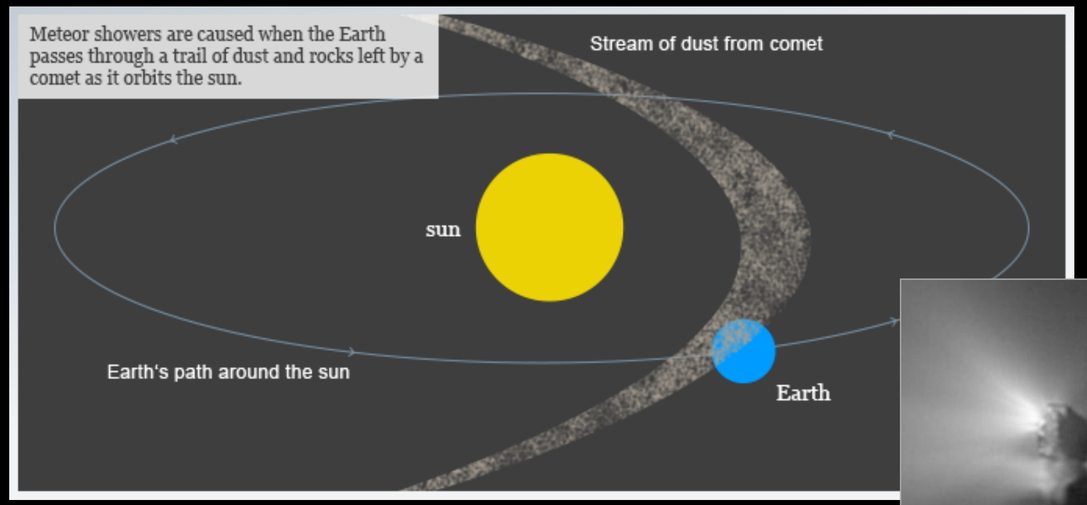


Image: NASA

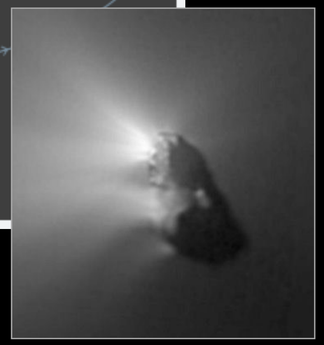


Image: ESA

Calendar of principal meteor showers

- Most are active for several days centred on the date of max activity.
- Date of maximum can vary slightly from one year to the other (i.e. leap year)
- A few showers are periodic (little or not active most years, occasionally spectacular)
- Many, many more minor showers!
- Each meteor shower unique for different reasons
  - Fast vs slow meteors
  - Optimal viewing time
  - Brightness
  - Rates variations
  - Meteor “appearance” (i.e. Geminids vs Perseids)

Morning of Maximum Activity	Name of Shower	Rough Hourly Count	Parent Comet
Jan. 3	Quadrantid	40	—
Apr. 21	Lyrid	10	1861I (Thatcher)
May 4	Eta Aquarid	20	Halley
June 30	Beta Taurid	25‡	Encke
July 30	Delta Aquarid	20	—
Aug. 11	Perseid	50	1862III (Swift-Tuttle)
Oct. 9	Draconid	up to 500	Giacobini-Zinner
Oct. 20	Orionid	30	Halley
Nov. 7	Taurid	10	Encke
Nov. 16	Leonid	12*	1866I (Tuttle)
Dec. 13	Geminid	50	3200 (Phaeton)†

**Every 33 years, as Earth passes through the densest region of this meteoroid swarm, we see intense showers that can exceed 1000 meteors per minute for brief periods. This intense activity is next expected to occur in 2032.*

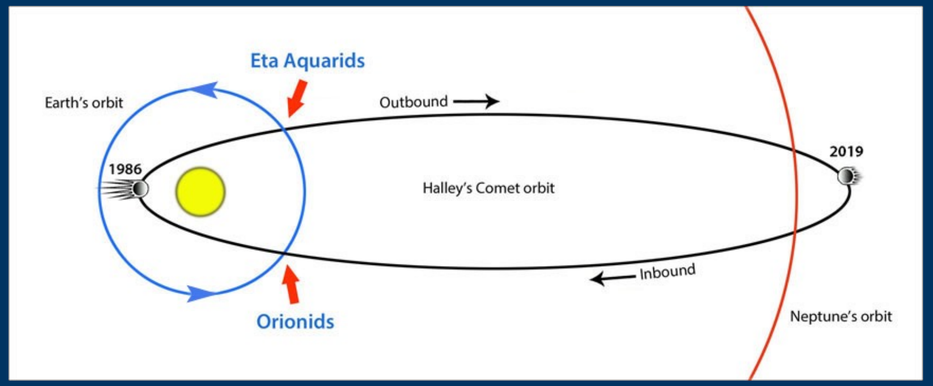
†*Phaeton is actually an asteroid and shows no signs of cometary activity, but its orbit matches the meteoroid paths very well.*

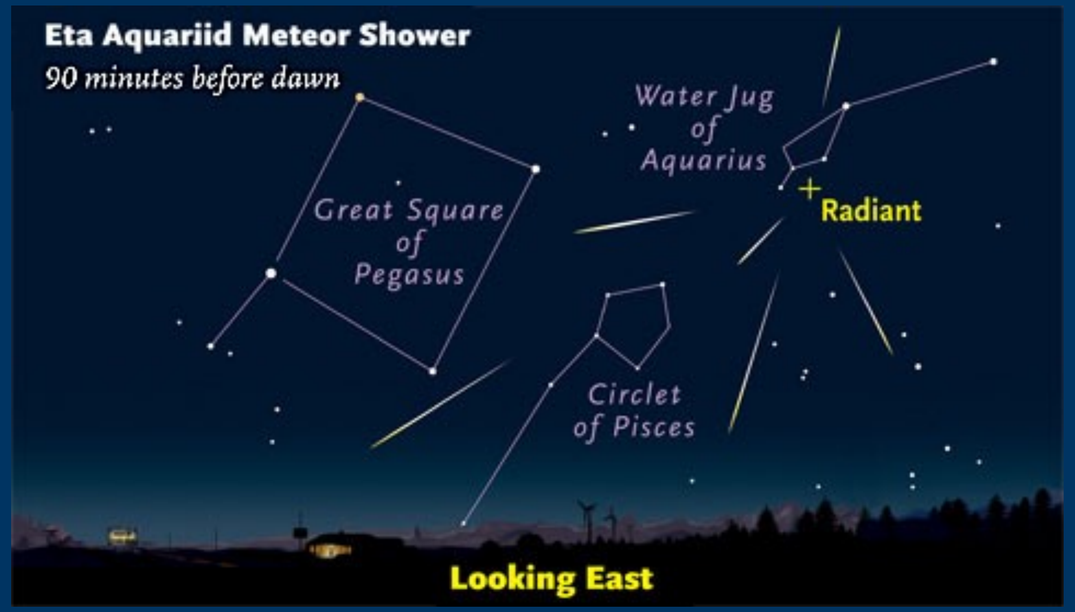
‡*Meteor count peaks after sunrise.*

Eta Aquariids: Peaks on May 5 - 7

- One of two annual showers associated with 1P/Halley.
- From Ottawa area, only visible for a short time from 3am EDT until dawn.
- Few meteors from 45 degrees latitude, but fast and long earthgrazers!
- Waxing gibbous moon low in western sky (better earlier in the month).

Image: NASA/W. Liller - NSSDC's Photo Gallery





Images: Sky & Telescope

Mid-summer Meteor Complex: July 26-August 2

- South Delta Aquariids is the main shower during this period.
- Activity supplemented by Capricornids, North Delta Aquariids, early Perseids, other minor showers and sporadics.
- Overall meteor rates elevated after midnight.
- Waxing First Quarter Moon setting around midnight (best during the first few nights of this period).

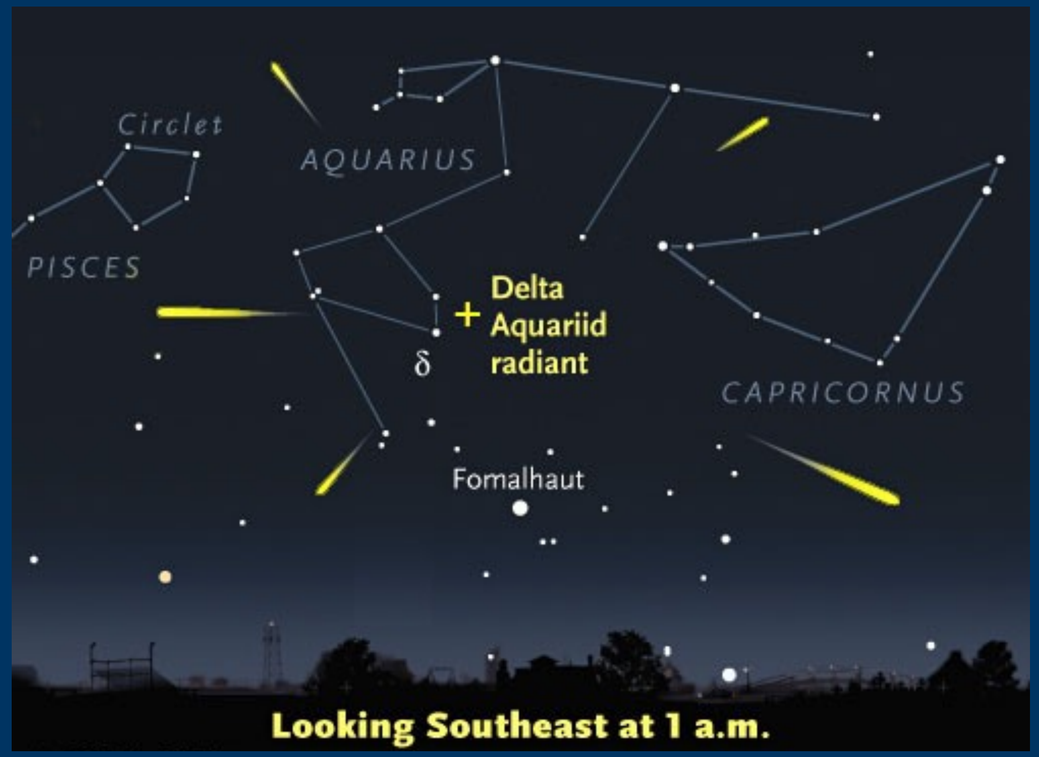


Image: Sky & Telescope

Perseids: Peaks on August 11/12

- Will suffer from presence of rising Last Quarter Moon.
- Earth will potentially cross a filament on August 12, around 10h UT (6am EDT) with ZHR of 100.
- Tends to produce brighter meteors during the nights leading up to the peak.
- **Cool fact:** In 2028 a strong outburst is predicted. Modelling showing the 1479 dust trail near Earth and **ZHR of 250-300 at 5-6 UT (1-2am EDT) Aug 12**. Even higher rates up to storm level are possible.

Photo: Pierre Martin

Orionids: October 21-24

- 1P/Halley's other shower.
- Usually a modest shower (ZHR of 20-25) but suspected to have a 12-year periodicity when elevated activity occurs.
- Higher activity phase of the cycle should fall between 2020–2022.
- First Quarter Moon will set early. Watch during the hours before dawn.
- **Cool fact:** The 2006-2007 Orionids produced a dramatic increase in both rates and fireballs, due to a mean-motion resonance with Jupiter, keeping the meteoroids together in a dense filament.

Photos: Pierre Martin

Leonids: November 16/17

- ZHR approx 10-20 in most years.
- Fastest meteors (71km/sec), some fireballs.
- Mikiya Sato's calculations shows possible "upticks" in activity. The most promising is between **06h50min UT (1:50am EST) and 08h13min UT (3:13am EST).**
- Excellent viewing conditions.
- **Cool fact:** The Leonids are most famous for producing the Great meteor storms of 1833, 1866, 1966 and 2001, when thousands of meteors were visible. The next stormy Leonid return is expected in 2094.

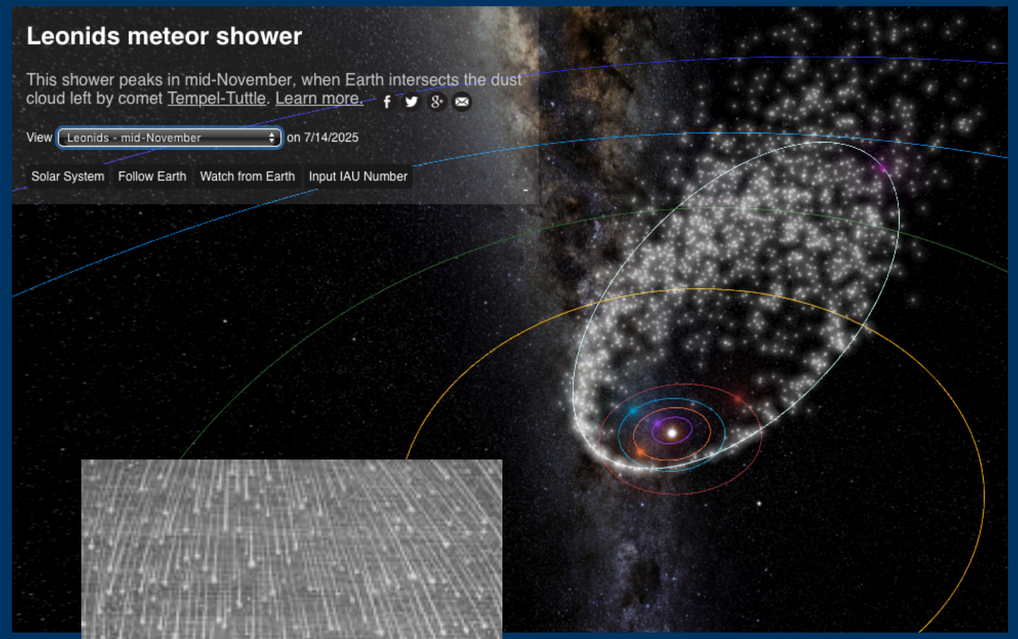


Image: www.meteorshowers.org

Geminids: December 13/14

- The most reliable and prolific shower.
- Has been gradually increasing every year with ZHR 140-150 at maximum.
- New Moon!
- Broad peak near 01 UT (8pm EST) Dec 14.
- **Cool fact:** The Geminids produce lots of bright, medium speed meteors. One of the few showers that can be enjoyed nearly all night. It produces good numbers already by mid-evening, and the radiant culminates near the zenith around 1-2am.

Photo: Pierre Martin

A strong year for Ursids? December 21/22

- May be the source of a significant outburst (**ZHR up to 400**), according to Peter Jenniskens.
- Dust trails released by 8P/Tuttle in 829 (**December 22, 06h10min UT (1:10am EST**) and 815 (**December 22, 03-22h UT (10pm to 5pm EST)**.
- Filament in a mean-motion resonance to be encountered on **December 22, 05h27min UT (12:27am EST)**.
- Less important activity increases from older dust trails may also happen.
- First Quarter Moon sets at 1am.

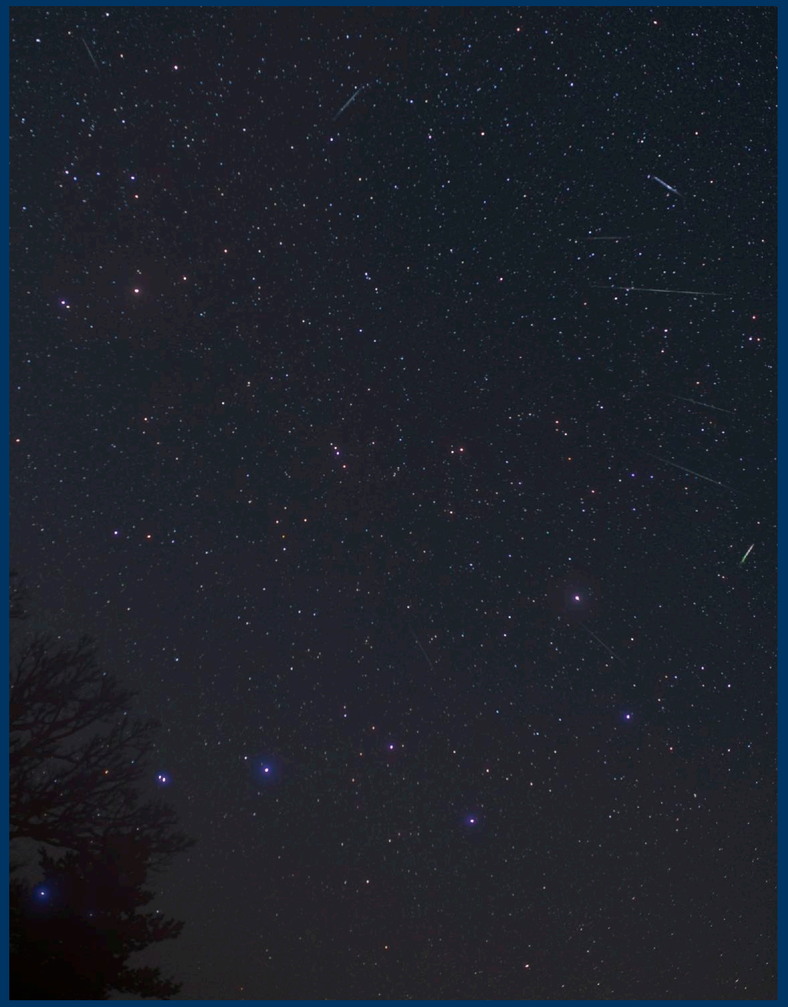


Photo: Pierre Martin

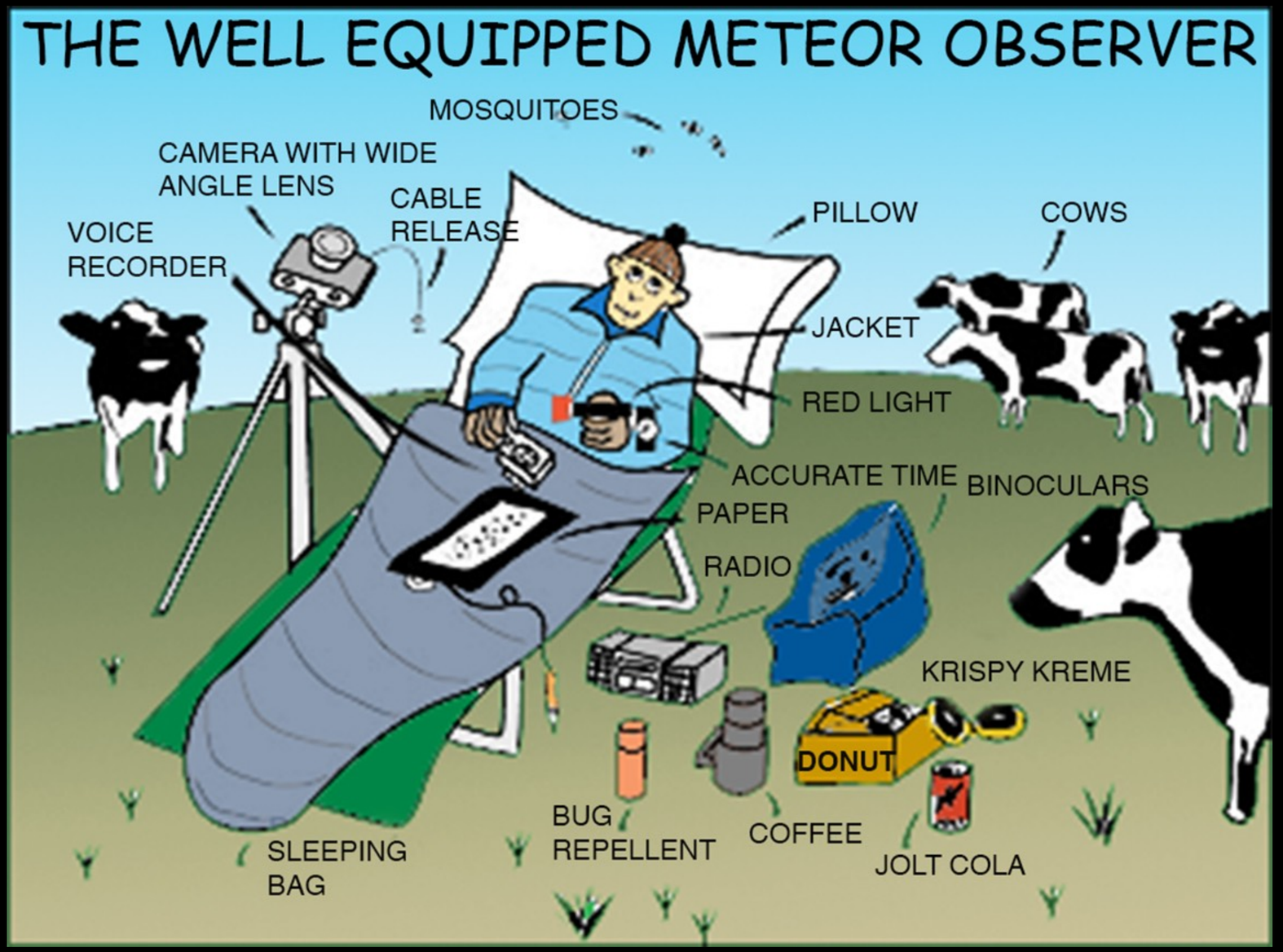
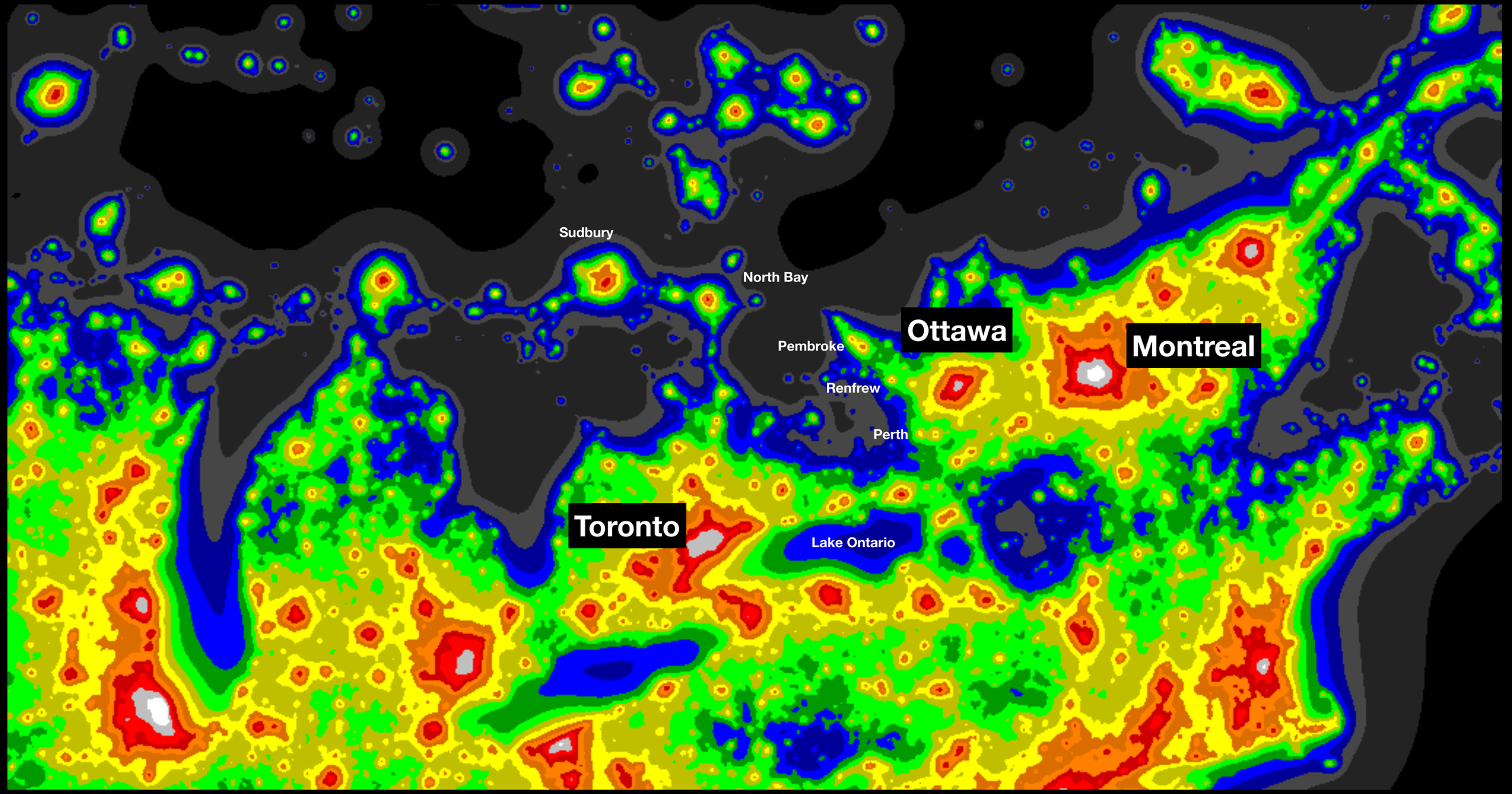
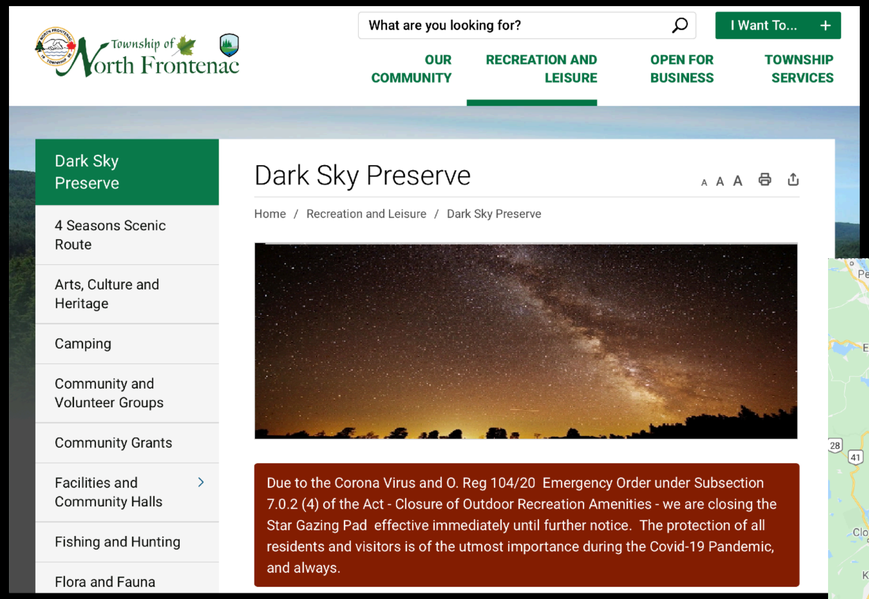


Illustration by Pierre Martin

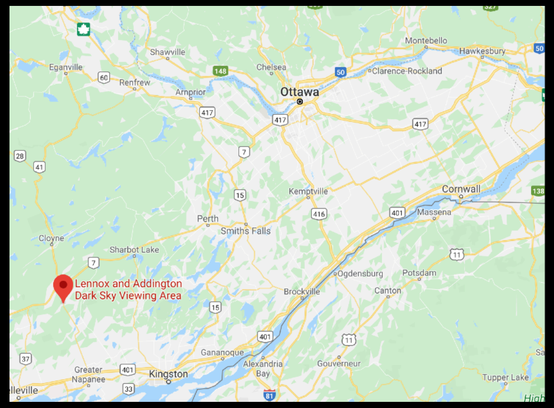
LIGHT POLLUTION



PUBLIC DARK OBSERVING SITES



Another option: Joining an astronomy club or group (RASC, OAOG, OAFs) for access to private dark sites near Ottawa



Due to Covid-19

WEATHER

Sponsored by these cool people:

RASC Ottawa Centre

Dave & Robert

Ottawa
Clear Sky Chart
legend page

Image Control

1. Hold your mouse over a block to explain color and details.
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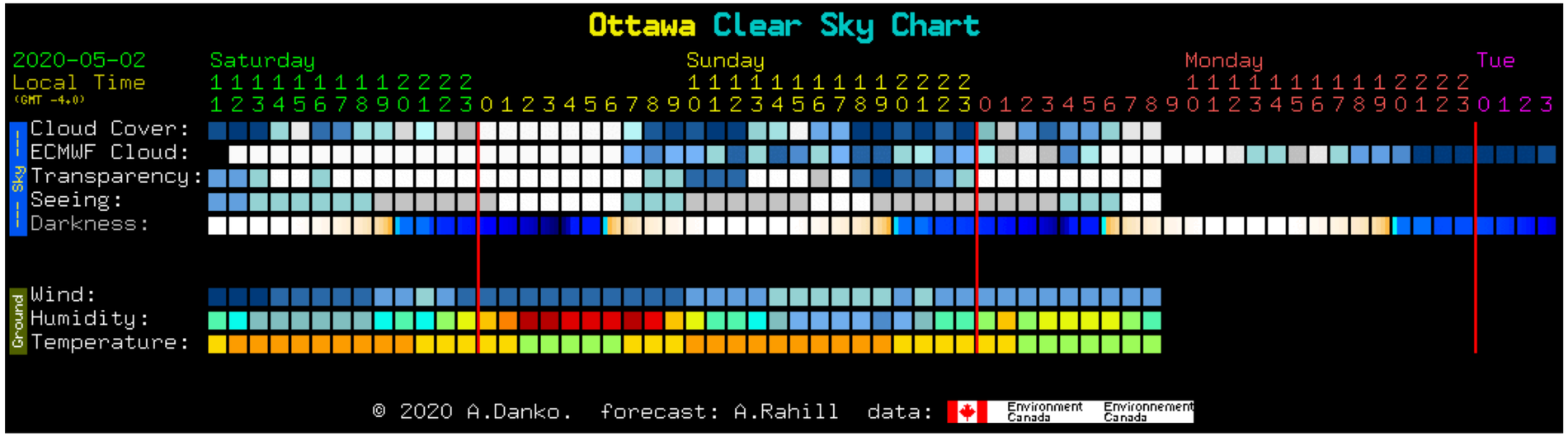


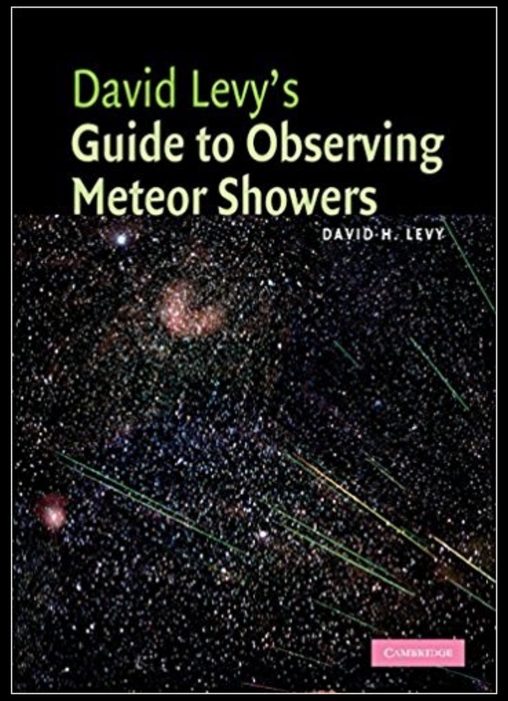
Home of the Ottawa RASC, the Ottawa Valley Astronomy and Observers Group, and the Ottawa Astronomy FriendS.

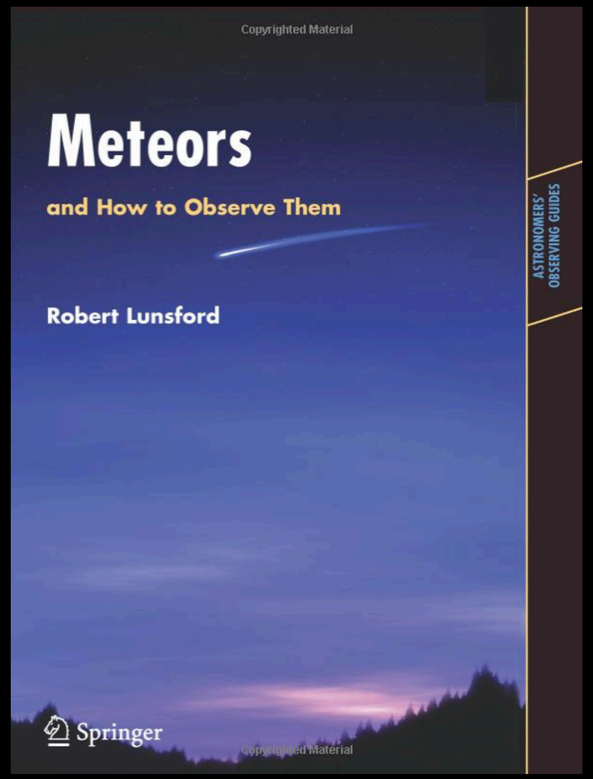
Other Charts

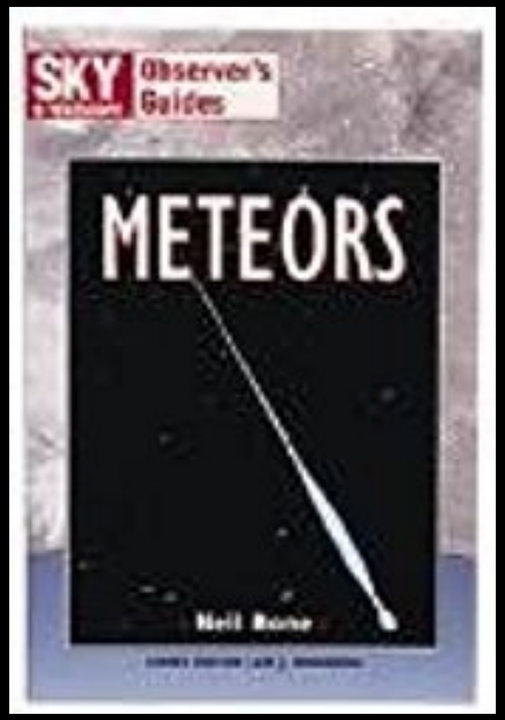
All	List Map
Ontario:	List Map
Within 100 Km:	List Map
Within 300 Km:	List Map

https://www.cleardarksky.com

RESOURCES TO LEARN MORE







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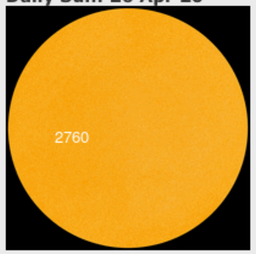
Current Conditions

Solar wind
speed: **392.6** km/sec
density: **5.8** protons/cm^3
more data: ACE, DSCOVR
Updated: Today at 2206 UT

X-ray Solar Flares
6-hr max: **A1** 2202 UT Apr26
24-hr: **A1** 2202 UT Apr26
explanation | more data
Updated: Today at: 2210 UT

Daily Sun: 26 Apr 20



Small sunspot AR2760 is a member of old Solar Cycle 24. It poses no threat for strong solar flares. Credit: SDO/HMI

Sunspot number: 11
What is the sunspot number?
Updated 26 Apr 2020

Spotless Days
Current Stretch: 0 days
2020 total: 90 days (77%)
2019 total: 281 days (77%)
2018 total: 221 days (61%)
2017 total: 104 days (28%)
2016 total: 32 days (9%)
2015 total: 0 days (0%)
2014 total: 1 day (<1%)
2013 total: 0 days (0%)
2012 total: 0 days (0%)
2011 total: 2 days (<1%)
2010 total: 51 days (14%)
2009 total: 260 days (71%)
2008 total: 268 days (73%)
2007 total: 152 days (42%)
2006 total: 70 days (19%)

What's up in space

Sunday, Apr. 26, 2020

Solar minimum is here - but even now strangely beautiful auroras are dancing around the poles. Deep inside the Arctic Circle, the expert guides of Aurora Holidays in Utsjoki, Finland, can help you chase them. Book now!

AURORA HOLIDAYS

OLD-CYCLE SUNSPOT: Just south of the sun's equator, a sunspot is growing: AR2760. Its magnetic polarity identifies it as a member of old Solar Cycle 24. This is probably one of the last old-cycle sunspots we will see as the sun continues tipping toward Solar Cycle 25. **Aurora alerts:** SMS Text.

METEOR SMOKE IN ACTION: The best meteor during this month's Lyrid meteor shower might not have been a Lyrid at all. On April 21st, Robert Barsa was outside the city of Košice, Slovakia, watching meteors fly out of the constellation Lyra when a flash lit up the sky from a completely different direction.

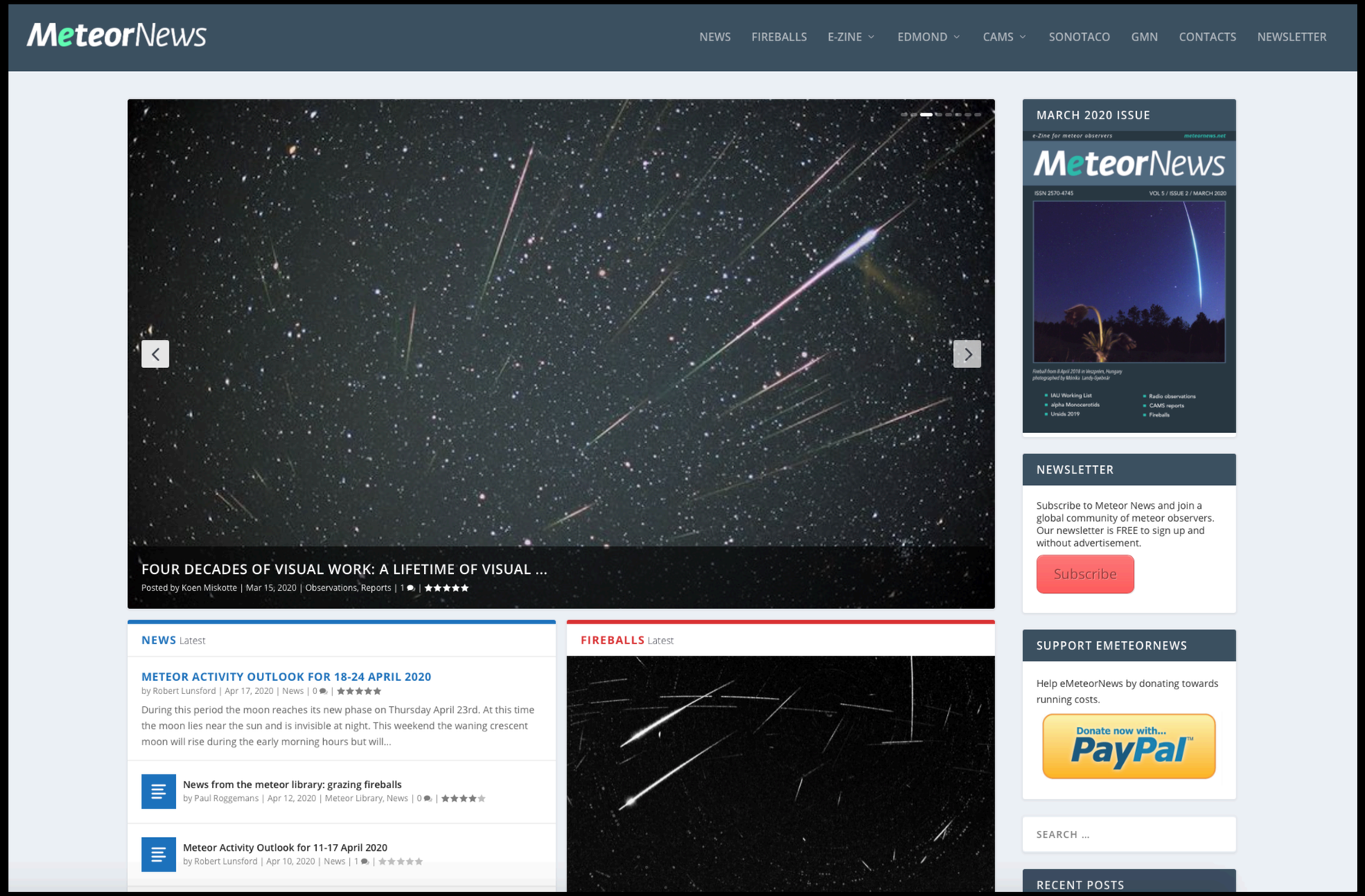
"I saw it in my peripheral vision," says Barsa. "As I looked reflexively above my head, I was speechless staring at a meteor much brighter than Venus."

"The fireball was moving very slowly with at least two outbursts," he says. "It reminded me of a decaying spaceship or satellite entering the atmosphere."

Barsa's video shows the remarkable behaviour of the meteor's debris twisting in rarefied winds more than 60 km above Earth's surface. "The smoky trail lasted for nearly an hour until it finally disappeared," he says. "Obviously, this was not a member of the Lyrids shower, but such bright 'uninvited guests' are always welcome."

Realtime Space Weather Photo Gallery
Free: Spaceweather.com Newsletter

archives
April 26 2020 view



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THANK YOU
Questions, comments?

Or you can email me:

Pierre Martin
meteorshowersca@yahoo.ca