

## METEORS

These descriptions of the annual meteor showers are fuller than in the TIMETABLE OF EVENTS but still bare; I expect to amplify them later.

“Shower” can be an optimistic term; what is typically seen is a dozen or so “shooting stars” per hour.

The showers picked out with bold type are celebrated ones, but some of them will be unfavorable this year because of moonlight.

Meteors that appear in showers belong to streams (generally following the orbits of comets from which they were shed), and can be identified by the direction from which they appear to come. Other meteors, seen moving in random directions, are called “sporadic.”

Peak dates are not precisely predictable. The spans of activity, too, during which outlying members of the stream may possibly be seen, are soft-edged.

The radiant is the point or small area in the sky from which meteors of a stream appear to radiate. Their tracks are essentially parallel, and they can appear in any part of the sky. The radiant’s position is given in degrees of right ascension and declination (epoch 2000).

ZHR, zenithal hourly rate, is the approximate number of meteors that might be seen per hour at the peak time by a single observer with the radiant overhead, and in perfect sky conditions. Actual rates seen are generally less. ZHR, like predicted peak time, is based on past observations; it is even more uncertain, and can vary greatly from year to year.

The velocity, in kilometers per second, is as in the upper atmosphere; in space it will have been greater. Velocities range from very swift, for meteors arriving from ahead of Earth (such as the Leonids, 71 km/sec), to as slow as 11 km/sec for those overtaking Earth.

The population index ( $r$ ) is a measure of the spread of the meteors in magnitude (brightness). 2.0 means many are bright, 3.0 means more are faint.

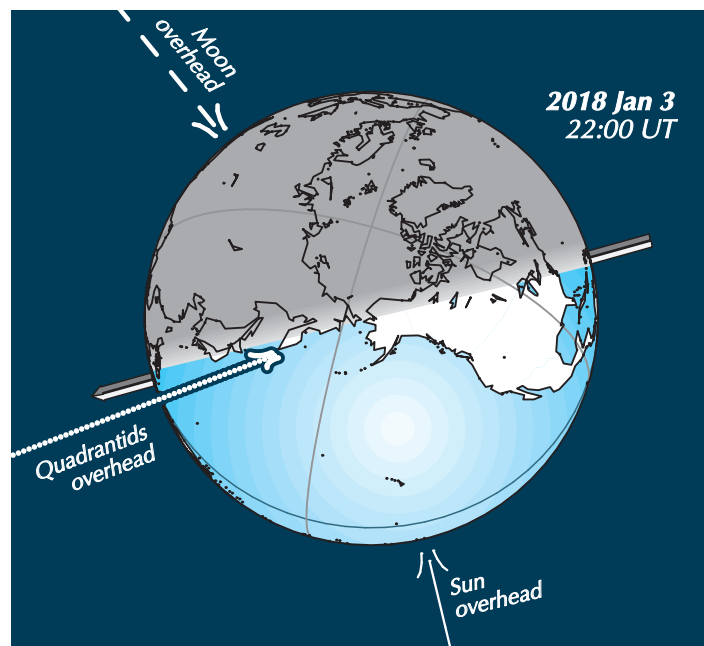
The Moon is an important factor. Full moonlight drowns out all but the brightest meteors. First Quarter Moon is out of the sky—and Last Quarter Moon in it—after midnight, which is when many of the showers are at their best.

Jan. 3 Wed.: **Quadrantids**. Peak 22 UT? Active Dec 28-Jan 12. Radiant  $2.4^\circ - .2^\circ$ . ZHR ~110. 41 km/sec. Population index 2.1. 2 days after Full Moon. Unfavorable. Named from a now disused constellation Quadrans Muralis, the “wall quadrant,” between Draco and Boötes.

Jan. 18 Thu.: Gamma Ursae Minorids. Active Jan 15-25. ZHR ~3. 31 km/sec. Population index 3.0. 1 day after New Moon.

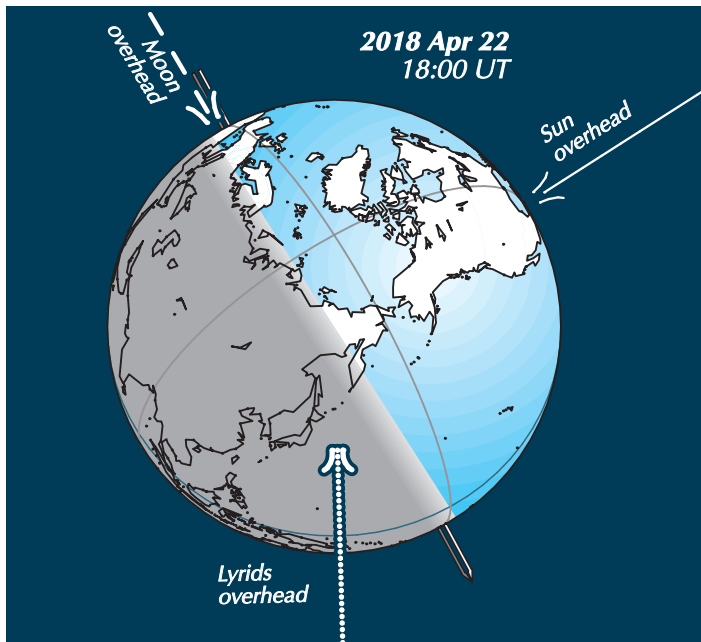
Feb. 8 Thu.: Alpha Centaurids. Peak 7 UT? Active Jan 28-Feb 21. ZHR ~10. 56 km/sec. Population index 2.0. 1 day after Last Quarter Moon. Unfavorable.

Mar. 15 Thu.: Gamma Normids. Active Feb 25-Mar 28. ZHR ~6. 56 km/sec. Population index 2.4. 3 days before New Moon.



Earth seen from north, at the shower’s presumed peak, which is in daytime for America, night for Europe. The particles from “overhead” are only part of a stream in space with many times Earth’s width. The arrow through Earth represents its flight along its orbit (the protruding part of the arrow in one minute).

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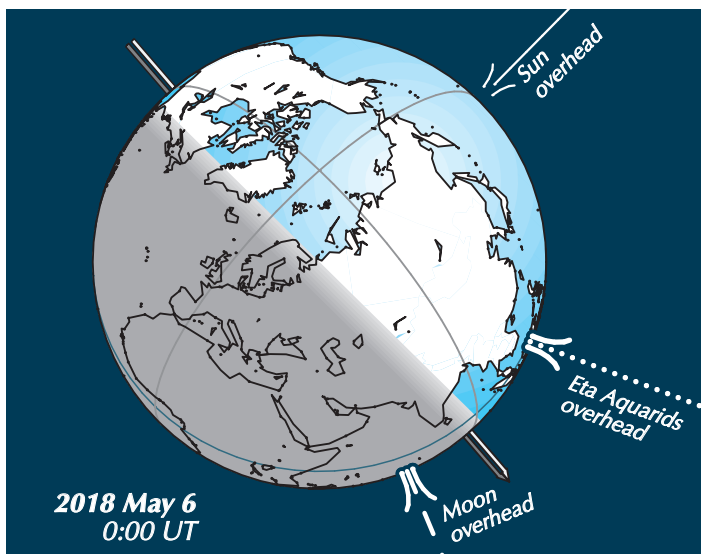


Apr. 22 SUN.: **Lyrids**. Peak 18 UT? Active Apr 16-25. Radiant  $4.4^\circ +1.1^\circ$ . ZHR ~18. 49 km/sec. Population index 2.1. Near First Quarter Moon. Very favorable.

Apr. 24 Tue.: Pi Puppids. Active Apr 15-28. ZHR ~10. 18 km/sec. Population index 2.0. 1 day after First Quarter Moon.

May 6 SUN.: **Eta Aquarids**. Active Apr 19-May 28. Radiant  $3.5^\circ +4.4^\circ$ . ZHR ~50. 66 km/sec. Population index 2.4. 2 days before Last Quarter Moon. Unfavorable.

The peak time is far from certain, and there could be bunches of faint meteors early in May 5. Derived from Halley's Comet, like the Orionids of Oct, 21,



May 9 Wed.: Eta Lyrids. Active May 3-14. ZHR ~3. 43 km/sec. Population index 3.0. 1 day after Last Quarter Moon.

June 7 Thu.: Daytime Arietids. Active May 14-Jun 24. ZHR ~9. 38 km/sec. Population index 2.8.

June 23 SAT.: June Boötids. Active Jun 22-Jul 2. Radiant  $1.6^\circ -2^\circ$ . ZHR ~10. 18 km/sec. Population index 2.2. 3 days after First Quarter Moon. No activity predicted.

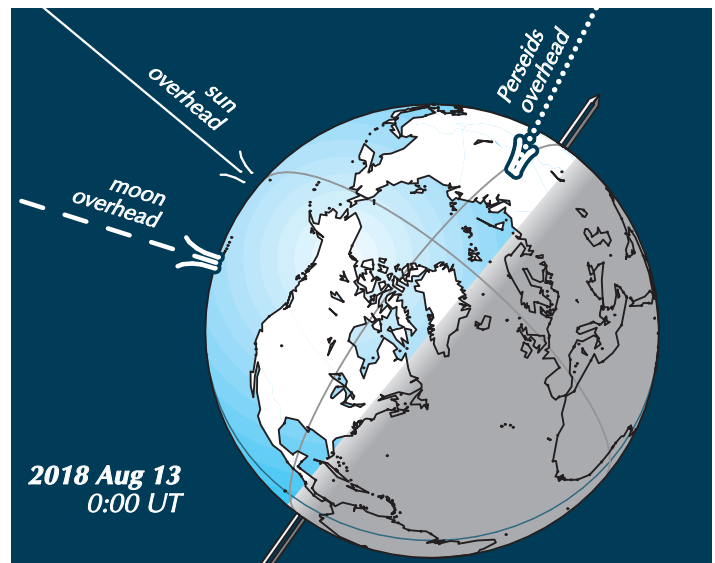
July 28 SAT.: Piscid Austrinids. Active Jul 15-Aug 10. Radiant  $3.4^\circ +3^\circ$ . ZHR ~5. 35 km/sec. Population index 3.2. Near Full Moon.

July 28 SAT.: July Gamma Draconids? Peak 12:30 UT? ZHR ~5. 1 day after Full Moon. Very unfavorable.

July 30 Mon.: **Southern Delta Aquarids**. Active Jul 12-Aug 23. Radiant  $3.0^\circ +2^\circ$ . ZHR ~25. 41 km/sec. Population index 2.5. 2 days after Full Moon. Very unfavorable.

July 30 Mon.: Alpha Capricornids. Active Jul 3-Aug 15. Radiant  $3.2^\circ +3^\circ$ . ZHR ~5. 23 km/sec. Population index 2.5. 2 days after Full Moon.

Aug. 13 Mon.: **Perseids**. Active Jul 17-Aug 24. Radiant  $5.6^\circ +2^\circ$ . ZHR ~110. 59 km/sec. Population index 2.2. 2 days after New Moon. Very favorable.



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Aug. 18 SAT.: Kappa Cygnids. Active Aug 3-25.  
Radiant  $1.0^{\circ} +.1^{\circ}$ . ZHR  $\sim 3$ . 25 km/sec.  
Population index 3.0. Near First Quarter Moon.

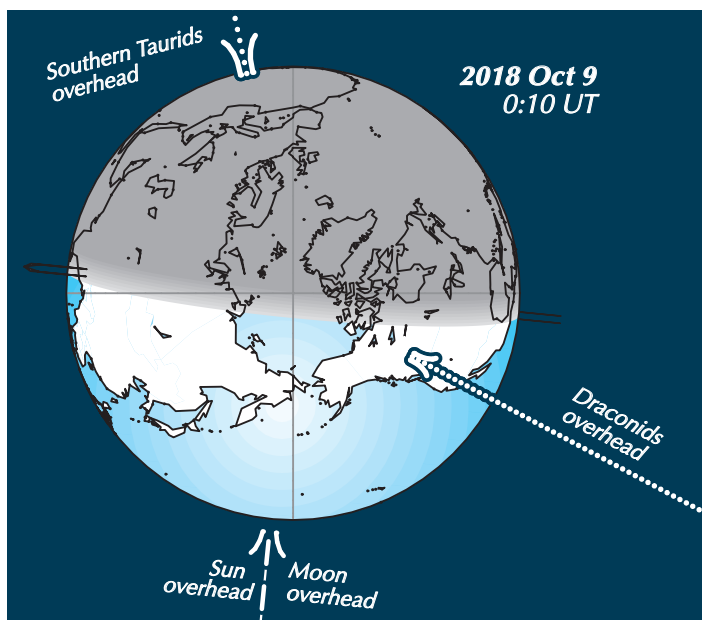
Sep. 1 SAT.: Aurigids. Active Aug 28-Sep 5.  
Radiant  $4.3^{\circ} -.1^{\circ}$ . ZHR  $\sim 10$ . 66 km/sec.  
Population index 2.5. 2 days before Last Quarter Moon.

Sep. 9 SUN.: September Epsilon Perseids.  
Peak 16 UT? Active Sep 5-21. Radiant  $4.3^{\circ} +.1^{\circ}$ .  
ZHR  $\sim 10$ . 64 km/sec. Population index 3.0. Near  
New Moon. Very favorable.

Sep. 27 Thu.: Daytime Sextantids. Active Sep 9-  
Oct 9. ZHR  $\sim 5$ . 32 km/sec. Population index 2.5.

Oct. 5 Fri.: October Camelopardalids. Peak 14  
UT? ZHR  $\sim 5$ . 3 days after Last Quarter Moon.

Oct. 9 Tue.: **Draconids**. Peak 0:10 UT? Active  
Oct 6-10. ZHR  $\sim 20$ . 20 km/sec. Population index  
2.6. Near New Moon. Very favorable.



Oct. 10 Wed.: Southern Taurids. Active Sep 10-  
Nov 20. Radiant  $2.9^{\circ} +.2^{\circ}$ . ZHR  $\sim 10$ . 27 km/sec.  
Population index 2.3. 1 day after New Moon.

Oct. 11 Thu.: Delta Aurigids. Active Oct 10-18.  
Radiant  $4.0^{\circ} -.4^{\circ}$ . ZHR  $\sim 2$ . 64 km/sec.  
Population index 3.0. 2 days after New Moon.

Oct. 18 Thu.: Epsilon Geminids. Active Oct 14-  
27. Radiant  $4.0^{\circ} +.1^{\circ}$ . ZHR  $\sim 3$ . 70 km/sec.  
Population index 3.0. 1 day after First Quarter  
Moon.

Oct. 21 SUN.: **Orionids**. Active Oct 2-Nov 7.  
Radiant  $2.6^{\circ} +.1^{\circ}$ . ZHR  $\sim 25$ . 66 km/sec.  
Population index 2.5. 4 days before Full Moon.  
Quite favorable.

Oct. 24 Wed.: Leo Minorids. Active Oct 19-27.  
Radiant  $4.0^{\circ} -.4^{\circ}$ . ZHR  $\sim 2$ . 62 km/sec.  
Population index 3.0. 1 day before Full Moon.

Nov. 12 Mon.: Northern Taurids. Active Oct 20-  
Dec 10. Radiant  $3.6^{\circ} +.2^{\circ}$ . ZHR  $\sim 5$ . 29 km/sec.  
Population index 2.3. 4 days before First Quarter  
Moon.

Nov. 18 SUN.: Leonids. Peak 22:30 UT? Active  
Nov 6-30. Radiant  $2.4^{\circ} -.3^{\circ}$ . ZHR  $\sim 15$ . 71  
km/sec. Population index 2.5. 3 days after First  
Quarter Moon. Favorable.

Nov. 21 Wed.: Alpha Monocerotids. Active Nov  
15-25. Radiant  $3.2^{\circ} -.2^{\circ}$ . ZHR  $\sim 10$ . 65 km/sec.  
Population index 2.4. 2 days before Full Moon.  
Unfavorable.

Nov. 28 Wed.: November Orionids. Active Nov  
13-Dec 6. ZHR  $\sim 3$ . 44 km/sec. Population index  
3.0. 2 days before Last Quarter Moon.

Dec. 1 SAT.: December Phi Cassiopeids. ZHR  
 $\sim 10$ . 19 km/sec. 1 day after Last Quarter Moon.

Dec. 2 SUN.: Phoenicids. Active Nov 28-Dec 9.  
Radiant  $3.2^{\circ} +.1^{\circ}$ . ZHR  $\sim 10$ . 18 km/sec.  
Population index 2.8. 2 days after Last Quarter  
Moon. No activity predicted.

Dec. 7 Fri.: Puppis-Velids. Active Dec 1-15.  
Radiant  $2.1^{\circ} +.1^{\circ}$ . ZHR  $\sim 10$ . 40 km/sec.  
Population index 2.9. Near New Moon. Very  
favorable.

Dec. 9 SUN.: Monocerotids. Active Dec 5-20.  
Radiant  $3.5^{\circ} +.1^{\circ}$ . ZHR  $\sim 3$ . 41 km/sec.  
Population index 3.0. 2 days after New Moon.

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Dec. 12 Wed.: Sigma Hydrids. Active Dec 3-15.  
Radiant  $3.2^{\circ}$   $-2^{\circ}$ . ZHR ~3. 58 km/sec.  
Population index 3.0. 3 days before First Quarter  
Moon.

Dec. 14 Fri.: **Geminids**. Peak 12:30 UT? Active  
Dec 4-17. Radiant  $4.0^{\circ}$   $-1^{\circ}$ . ZHR ~120. 35  
km/sec. Population index 2.6. 1 day before First  
Quarter Moon.

Dec. 16 SUN.: Coma Berenicids. Active Dec 12-  
23. Radiant  $3.2^{\circ}$   $-3^{\circ}$ . ZHR ~3. 65 km/sec.  
Population index 3.0. 1 day after First Quarter  
Moon.

Dec. 20 Thu.: December Leo Minorids. Active  
Dec 5-Feb 4. ZHR ~5. 64 km/sec. Population  
index 3.0. 3 days before Full Moon.

Dec. 22 SAT.: Ursids. Active Dec 17-26. Radiant  
 $0.0^{\circ}$   $-4^{\circ}$ . ZHR ~15. 33 km/sec. Population index  
3.0. 1 day before Full Moon. Very unfavorable.