International Meteor Organization

2026 Meteor Shower Calendar

edited by Jürgen Rendtel [1]

1 Introduction

Welcome to the thirty-sixth edition of the International Meteor Organization (IMO) Meteor Shower Calendar. Its main goal is to draw the attention of observers to both regularly returning meteor showers and to events which may be possible according to model calculations. Additional peaks and/or enhanced rates found by observations, and observational evidence of no rate or density enhancement at predicted moments are of scientific interest. Rate and timing data may help to improve our knowledge about meteoroid streams. We hope the Calendar continues to be a useful tool to plan your meteor observing activities.

Video meteor camera networks are collecting data throughout the year. Nevertheless, visual observations comprise an important data sample for many showers, and the well established analysing procedures allow us to derive reliable flux density data. Because visual observers are more affected by moonlit skies than video cameras, we consider the moonlight circumstances when describing the visibility of meteor showers. For the three strongest annual shower peaks in 2026, we find the Quadrantid peak at Full Moon and moon-free nights for the peaks of the Perseids and the Geminids. The η-Aquariid maximum occurs about four days after the Full Moon and conditions are also poor for the maximum periods of the Southern δ-Aquariids, the Aurigids and the Ursids. No moonlight disturbance will affect near-maximum observations of the April Lyrids, the September ε-Perseids, the October Draconids, the Orionids and the Leonids.

The heart of the Calendar is the Working List of Visual Meteor Showers (Table 5, page 25) which is continuously updated so that it is the single most accurate listing available anywhere today for visual meteor observing. Nevertheless, it is a **Working** List which is subject to further modifications, based on the best data we had at the time the Calendar was written. Observers should always check for later changes noted in the IMO's journal *WGN* or on the IMO website. Vice versa, we are always interested to receive information whenever you find any anomalies! In the Calendar we refer to the shower designation as listed by the IAU's Meteor Data Center, which has 110 "established showers" (2025 June 13).

[1]Based on information in the *Meteor Observers Workbook 2014*, edited by Jürgen Rendtel (referred to as 'WB' in the Calendar), and "A Comprehensive List of Meteor Showers Obtained from 10 Years of Observations with the IMO Video Meteor Network" by Sirko Molau and Jürgen Rendtel (referred to as 'VID' in the Calendar), as amended by subsequent discussions and additional material extracted from data analyses produced since as well as publications which are listed in the *References* in section 8. Masahiro Koseki helped with important data concerning the SLY and COM activities. I particularly thank Mikhail Maslov, Mikiya Sato and Jérémie Vaubaillon for new information and comments in respect of events in 2026. Hiroshi Ogawa and Chris Steyaert evaluated information concerning daytime showers detectable by radio forward scatter observations. Last but not least thanks to Alastair McBeath, Tim Cooper, Robert Lunsford, Mikhail Maslov, Chris Steyaert and Cis Verbeeck for carefully checking the contents.

Interesting encounters are listed in Table 6a (page 27). Since there is always a possibility of completely unexpected events, ideally meteor observing should be performed throughout the year. This way we can improve the data for established meteoroid streams covering their entire activity periods. Combining data obtained with different techniques improves the reliability of derived quantities and is helpful for calibrating purposes.

Video meteor observations allow us to detect weak sources. An increasing number of confirmed radiants provides us with more possibilities to establish relations between meteoroid streams and their parent objects. Some of the sources may produce only single events but no annual recurring showers, such as, for example, the June Boötids, the τ-Herculids or the α-Monocerotids.

Observing techniques which allow the collection of useful shower data include visual, video and still-imaging along with radar and radio forward scatter methods. Visual and video data allow rate and flux density calculations as well as determination of the particle size distribution in terms of the population index r or the mass index s. Multi-station camera setups provide us with orbital data, essential for meteoroid-stream investigations. Showers with radiants too near the Sun for observing by the various optical methods can be detected by forward-scatter radio or back-scatter radar observations. The list of daytime showers (Table 7) has been updated referring to IAU-established showers including comments on their detectability provided by Hiroshi Ogawa.

The IMO's aims are to encourage, collect, analyze, and publish combined meteor data obtained from sites all over the globe, to improve our understanding of the meteor activity detectable from the Earth's surface. For best effects, it is recommended that all observers should follow the standard IMO observing guidelines when compiling information, and submit those data promptly to the appropriate Commission for analysis (contact details are at the end of the Calendar). Many analyses try to combine data obtained by more than one method, extending the ranges and coverage but also to calibrate results from different techniques. Thanks to the efforts of the many IMO observers worldwide since 1988 that have done this, we have been able to achieve as much as we have to date, including keeping the shower listings vibrant. This is not a matter for complacency however, since it is solely by the continued support of many people across the planet that our attempts to construct a better and more complete picture of the near-Earth meteoroid flux can proceed.

Timing predictions are included below on all the more active night-time and daytime shower maxima as reliably as possible. However, it is essential to understand that in many cases, such maxima are not known more precisely than to the nearest degree of solar longitude. In addition, variations in individual showers from year to year mean past returns are only a guide as to when even major shower peaks can be expected. As noted already, the information given here may be updated and added-to after the Calendar has been published. Some showers are known to show particle mass-sorting within their meteoroid streams, so the radar, radio, still-imaging, video and visual meteor maxima may occur at different times from one another, and not necessarily just in those showers. The majority of data available are for visual shower maxima, so this must be borne in mind when employing other observing techniques.

Whenever you are able to observe, we wish you all a most successful year's work and very much look forward to receiving your data, whose input is possible via the online form on the IMO's website `www.imo.net`. Clear skies!

2 Antihelion Source

The Antihelion Source (ANT) is a large, roughly oval area of about 30° in right ascension and 15° in declination, centred about 12° east of the solar opposition point on the ecliptic, hence its name. It is not a true shower at all (and therefore has no IAU shower number[2]), but is rather a region of sky in which a number of variably, if weakly, active minor showers have their radiants. IMO video results have shown that even instrumentally, it was impossible to define distinct and constantly observable radiants for many of the showers here! Thus we recommend observers simply to identify meteors from these showers as coming from the ANT alone.

Apart from this, we have been able to retain the α-Capricornids and particularly the Southern δ-Aquariids in July to August as apparently distinguishable showers separate from the ANT. Later in the year, the Taurid showers dominate the activity from the Antihelion region meaning the ANT should be considered inactive while the Taurids are underway, from late September into December. To assist observers, a set of charts showing the location for the ANT and any other nearby shower radiants is included here, to complement the numerical positions of Table 6, while comments on the ANT's location and likely activity are given in the quarterly summary notes.

3 January to March

Meteor observers may be able to check on an interesting possible minor event just after the start of the year. Maslov finds that meteoroids ejected from **comet 255P/Levy** in 1897 will approach the Earth on January 1 at $12^{h}46^{m}$ UT ($\lambda_{\odot} = 280\overset{\circ}{.}752$). Particles which may cause meteors will have left the comet at high velocities, and the trail is thin, hence the activity is expected to be low. Unfortunately, bright moonlight will badly affect any observations. The computed radiant of the slow meteors (18 km/s) is at $\alpha = 330°, \delta = +60°$, which is about 2° northwest of ζ Cephei.

The first of the large annual showers, the **Quadrantids (010 QUA)**, peak on January 3 close to 21^{h} UT. At this time we find the Full Moon near β Geminorum thus illuminating the sky during the entire night. Even if the sky is very transparent and moonlight is shielded, the number of visual shower meteors will be reduced a lot.

Some meteors of the **Comae Berenicids (020 COM)** can be observed until end January.

On 2015 January 10 at $02^{h}50^{m}$ UT, radar and video data showed an outburst of the **κ-Cancrids (793 KCA**; radiant at $\alpha = 138°$, $\delta = +9°$) at $\lambda_{\odot} = 289\overset{\circ}{.}315$. Data of the SonotaCo Network find the shower annually over the past decade around January 10. There are hints that the KCA event of 2015 may have been an enhancement of the o-Leonids (515 OLE). Both are in the working list of the IAU MDC and require more data. The outburst position of the 2015 activity is reached on 2026 January 9 near $22^{h}30^{m}$ UT (disturbed by the Moon at last quarter). At this time, the radiant of the Antihelion source centre is located at $\alpha = 122°$, $\delta = +19°$, roughly 20° northeast of the KCA radiant; KCA meteors (V_{∞} = 47 km/s) are faster than those from the ANT (V_{∞} = 30 km/s).

Around January 18 we find weak activity of the **γ-Ursae Minorids (404 GUM)**.

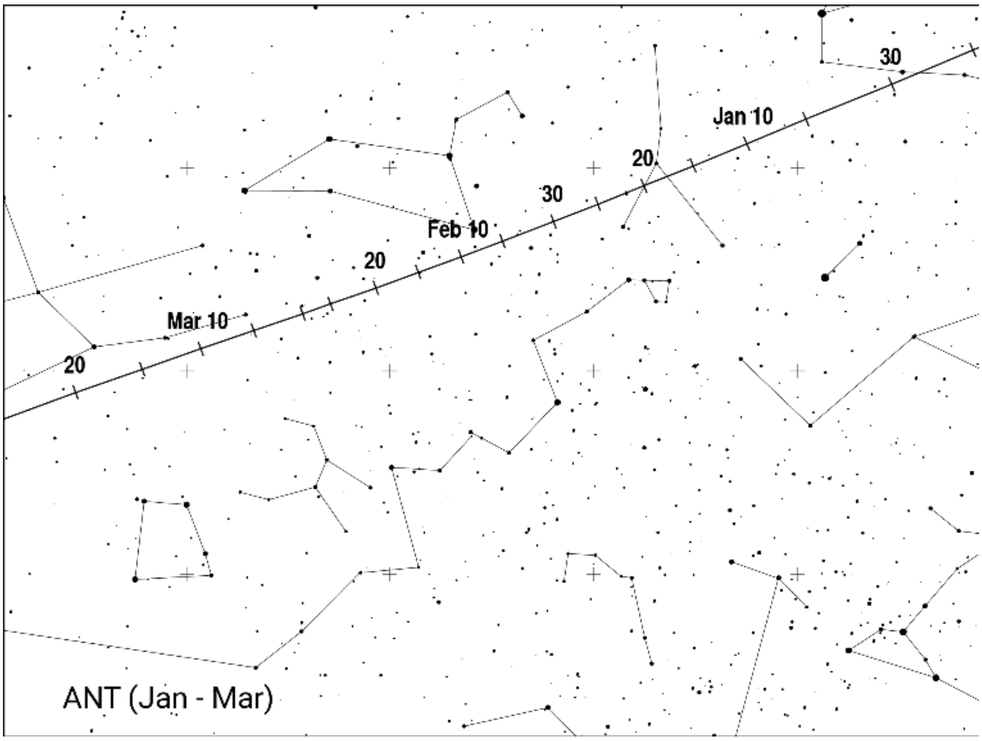
The **ι-Centaurids (919 ICN)** – not in our working list – appear to be active annually, albeit with fairly low rates. In 2024 Tim Cooper from South Africa reported enhanced activity between January 21–26. The shower of fast meteors (V_{∞} = 64km/s) with a radiant at $\alpha = 199°, \delta = -39°$ could benefit from dedicated visual observation; this time with no moonlight disturbance.

[2]There is an entry in the IAU Meteor Shower DataBase: 1079 ANT = August ν-Taurids. In our Calendar we use ANT for the Antihelion meteors only; the 1079 ANT do not cause visually detectable activity.

The **α-Centaurids (102 ACE)** reach their maximum around February 8 and perhaps later – see the ACE description on page 5.

The **ANT's** radiant centre is in south-east Gemini in early January, and crosses Cancer during much of the month, before passing into southern Leo for most of February. It then shifts through southern Virgo during March – see the chart shown below.

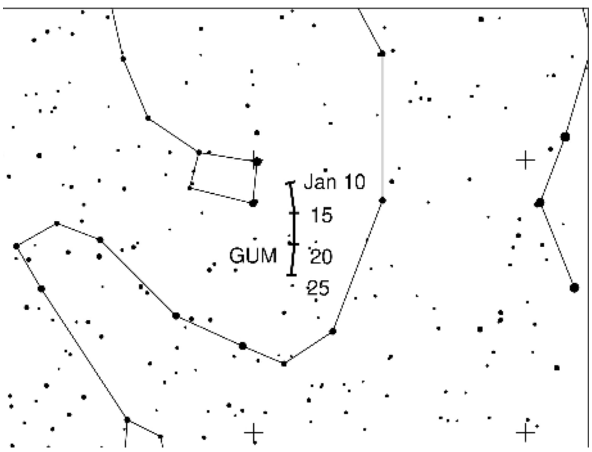
Probable ZHRs will be of the order of 2 to 3 during most of the time. Video meteor flux density data indicate a slight increase in March around $\lambda_\odot \approx 355°$ (corresponding to 2026 March 15/16).



γ-Ursae Minorids (404 GUM)

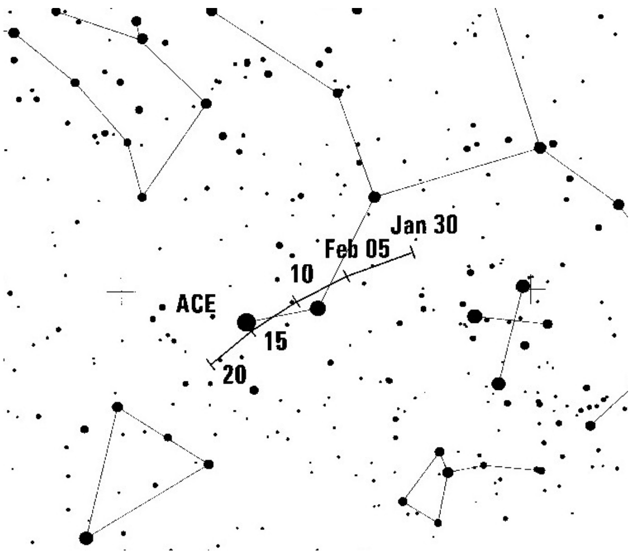
Active: January 10–22; Maximum: around January 18 ($\lambda_\odot = 298°$); ZHR ≈ 3;
Radiant: $\alpha = 228°$, $\delta = 67°$; Radiant drift: see Table 6; $V_\infty = 31$ km/s; $r = 3.0$.

This minor shower has been found in both video and visual data recently. It was included in our Working List from 2017 onwards, and has been observed annually since. Considering the velocity, meteors from this far northern radiant should be similar to the Ursids in their appearance. All data about the activity period and shower parameters should be treated as tentative and require further confirmation. New Moon on January 18 allows undisturbed observations during the entire activity period.



α-Centaurids (102 ACE)

Active: January 31–February 20; Maximum: February 8 ($\lambda_\odot = 319.^\circ4$);
ZHR variable, usually ≈ 6;
Radiant: $\alpha = 211°$, $\delta = -58°$; Radiant drift: see Table 6; $V_\infty = 58$ km/s; $r = 2.0$.



The α-Centaurids are mainly known from their appearances in 1974 and 1980 when bursts of only a few hours' duration apparently yielded ZHRs close to 20–30. The average peak ZHR between 1988–2007 was merely 6 though (WB, p. 18), albeit coverage has frequently been extremely patchy. Significant activity was reported on 2015 February 14 (airborne observation) although there was no confirmation of an outburst predicted for 2015 February 8. An outburst during 2021 February 13–15 associated with the γ-Crucids (1047 GCR) might have been a return of the α-Centaurids.

Conditions for visual observations are better for the period after the assumed maximum (last quarter Moon on Feb 09).
Further data is needed to obtain information about the stream which is not clearly detectable recently by visual and video observations. The shower's radiant is nearly circumpolar for much of the sub-equatorial inhabited Earth and is at a useful elevation from late evening onwards.

4 April to June

In this period the meteor rates increase significantly, but much of the total meteor activity in late April into May remains unobservable for optical methods as it is caused by daytime showers with their radiants located less than about 30° distant from the Sun.

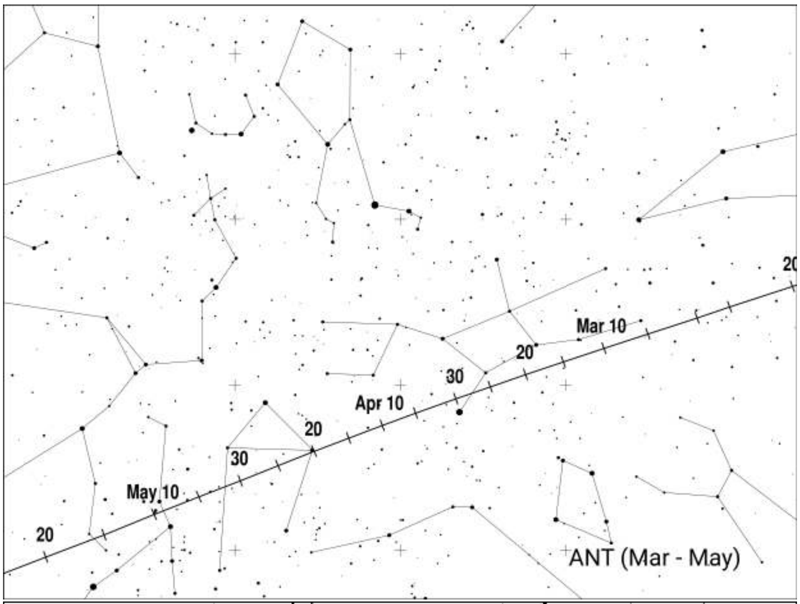
There is a chance to observe meteors originating from comet **249P/LINEAR** on April 18 centred at $14^\mathrm{h}42^\mathrm{m}$ UT when dust released from the comet in 1969 approaches the Earth as calculated by Maslov. The radiant of the slow meteors (28 km/s) is at $\alpha = 206°, \delta = -20°$. This is about 8° SSE from α Vir (Spica). The more favourable locations to observe from close to the given time are Australia, New Zealand and parts of Southeast Asia (no moonlight). Rate estimates are difficult, but there may be "a few dozen". The comet passed its perihelion on 2025 February 1.

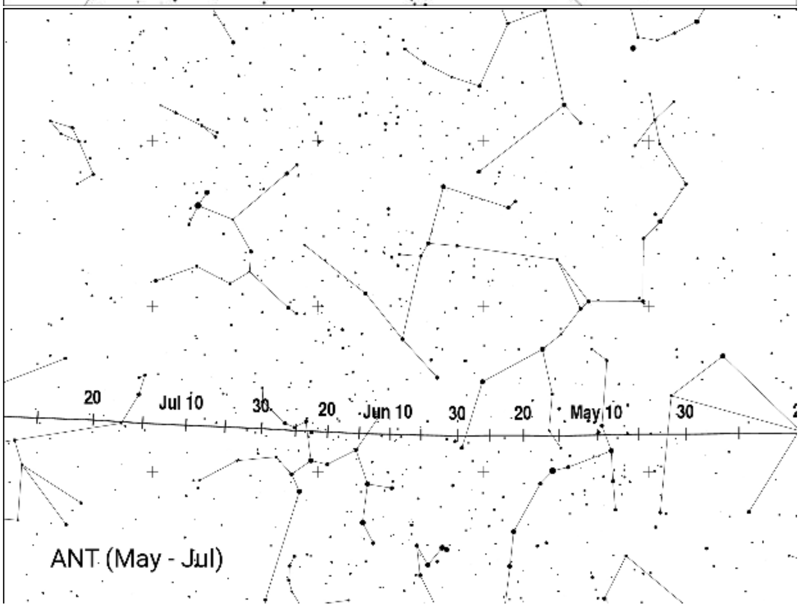
The maximum of the **April Lyrids (006 LYR)** is due on April 22. On April 24, the first quarter Moon will disturb optical observations of the **π-Puppid (137 PPU)** maximum as their radiant is only above the horizon in the evening hours.

Observations of the maximum of the **η-Aquariids (031 ETA)** will be disturbed by the gibbous waning Moon. Conditions are better for the minor **η-Lyrids (145 ELY)** with activity around May 11. Recent video data indicate that the maximum of the weak **June Boötids (170 JBO)** may be expected on June 22.

According to analyses of visual and video IMO data, the **ANT** should produce ZHRs of the order of 4–5 with insignificant variations. The radiant area drifts from south-east Virgo through

Libra in April, then across the northern part of Scorpius to southern Ophiuchus in May, and on into Sagittarius for much of June (charts below).





Daytime showers: In the second half of May and throughout June, most of the meteor action switches to sources with their radiants in the daylight sky (see also Table 7 at page 27). Here we give the data of the IAU MDC and recent findings (Ogawa, 2022; 2023) and some brief comments.

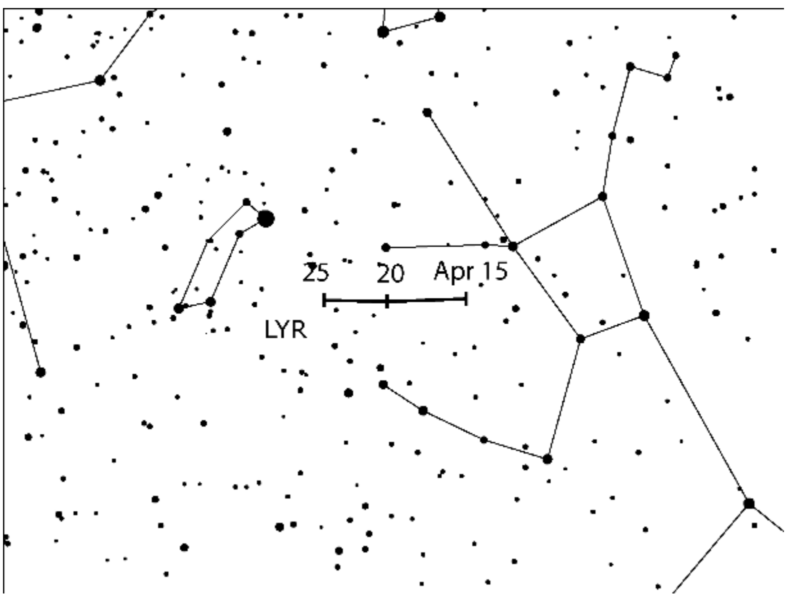
Shower	Maximum $\lambda_\odot$ (Date) IAU MDC	Maximum $\lambda_\odot$ (Date) Ogawa
April Piscids (144 APS)	26°0 (Apr 16)	32°6 (Apr 23)
N. ω-Cetids (152 NOC)	47°8 (May 08)	52°0 (May 13)
S. ω-Cetids (153 OCE)	48°6 (May 09)	48°8 (May 09)
S. May Arietids (156 SMA)	52°7 (May 13)	
Arietids (171 ARI)	76°7 (Jun 07)	77°8 (Jun 08)
ζ-Perseids (172 ZPE)	78°6 (Jun 09)	83°5 (Jun 14)
β-Taurids (173 BTA)	96°7 (Jun 28)	

For the **April Piscids (144 APS)**, Ogawa (2022) finds an activity which seems to be of similar strength to the radio Ursids of December in the period $\lambda_\odot = 30\overset{\circ}{.}5 - 34\overset{\circ}{.}5$ and a maximum at $\lambda_\odot = 32\overset{\circ}{.}6$. This differs significantly from the values in the IAU MDC database: maximum at $\lambda_\odot = 26°$ (April 16) or even earlier. This early date is before the start date found by Ogawa (2022) and requires observations. Later in May there are three showers: 152 NOC, 153 OCE, 156 SMA, with radiants relatively close to one another and overlapping activity periods. Therefore it is probably not possible to separate the activity of these showers in radio forward scatter observations. We may perhaps identify a broad activity profile around $\lambda_\odot = 50°$ (2026 May 10/11). The **Arietids (171 ARI)** is the strongest of the daytime showers, but again we find an overlap, now with the **ζ-Perseids (172 ZPE)** between 73° and 88°. The actual duration of the shower(s) is not well known.

April Lyrids (006 LYR)

Active: April 14–30; Maximum: April 22, 19^h40^m UT ($\lambda_\odot = 32\overset{\circ}{.}32$, but may vary – see text);
ZHR = 18 (can be variable, up to 90);
Radiant: $\alpha = 271°$, $\delta = +34°$; Radiant drift: see Table 6;
$V_\infty = 49$ km/s; $r = 2.1$.

The $\lambda_\odot = 32\overset{\circ}{.}32$ (2026 April 22, 19^h40^m UT) timing given here refers to the ideal maximum position found in *IMO* results from 1988–2000. However, the maximum time was variable from year to year. The recent maxima have been found between $\lambda_\odot = 32\overset{\circ}{.}2$–$32\overset{\circ}{.}5$ (equivalent to 2026 April 22, 16^h40^m to April 23, 00^h00^m UT). Usually, the peak activity at the ideal time produced higher ZHRs, ≈ 23. It seems that the further the peak happened from the reference position, the lower the reported ZHRs were, down to ≈ 14 – a relation which needs to be confirmed. Further, the shower's peak length varied. A ZHR of more than half of the peak value was found on average for 32.1 hours, but this duration varied between 14.8 and 61.7 hours. The best rates are normally achieved for just a few hours. The analysis also confirmed that occasionally, as their highest rates occurred, the Lyrids produced a brief increase in fainter meteors. In 1982 a short-lived ZHR of 90 was recorded.



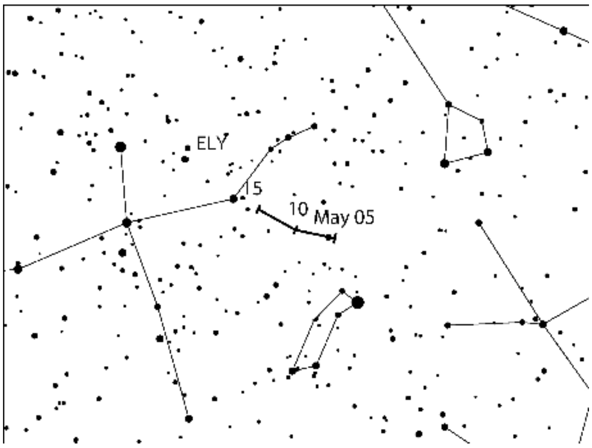
For 2026 there are no predictions for any activity increase from theoretical modelling of this shower associated with the long-period comet C/1861 G1 (Thatcher).

Lyrid meteors are best viewed from the northern hemisphere, but are visible from many sites north and south of the equator. As the radiant rises during the night, watches can be carried out usefully after about 22^h30^m local time from mid-northern sites, but only well after midnight from the mid-southern hemisphere. The Moon reaches its first quarter on April 24, so will cause no observing problems.

η-Lyrids (145 ELY)

Active: May 5–14; Maximum: May 10 ($\lambda_\odot = 50°$); ZHR = 3;
Radiant: $\alpha = 291°$, $\delta = +43°$; Radiant drift: see Table 6; $V_\infty = 43$ km/s; $r = 3.0$.

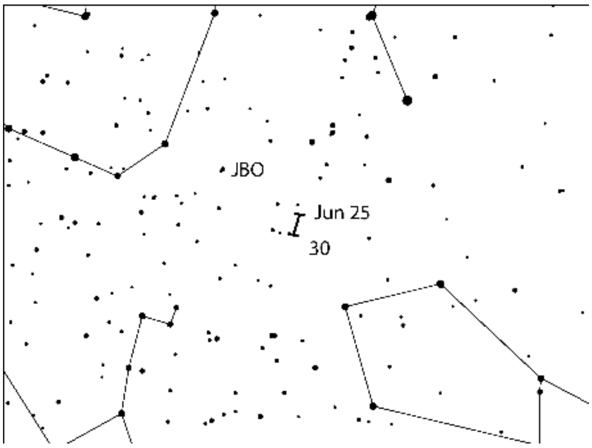
This weak shower is associated with Comet C/1983 H1 IRAS-Araki-Alcock. Most of the observational data on the shower has come from video results which define the radiant and the maximum position reliably.



Visual data obtained between 2007 and 2021 yield an average peak ZHR of 3–4 between $\lambda_\odot = 49°$ and 50°. Care needs to be taken to separate any potential η-Lyrids from the sporadics. The radiant area is usefully on-view all night from the northern hemisphere (primarily). The maximum occurs after the last quarter of the Moon, so the circumstances to observe meteors of the shower are reasonably good.

June-Boötids (170 JBO)

Active: June 22–July 2; Maximum: June 22, 01$^{\rm h}$ UT ($\lambda_\odot = 90\overset{\circ}{.}3$);
ZHR = variable, 0–100+;
Radiant: $\alpha = 221°$, $\delta = +48°$; Radiant drift: see Table 6; $V_\infty = 18$ km/s; $r = 2.2$.



This shower is known for its returns of 1998 and 2004. The return predicted in 2010 yielded a poorly established ZHR < 10 on June 23–24. Prior to 1998, only three more probable returns had been detected, in 1916, 1921 and 1927 (however, with different reliability).

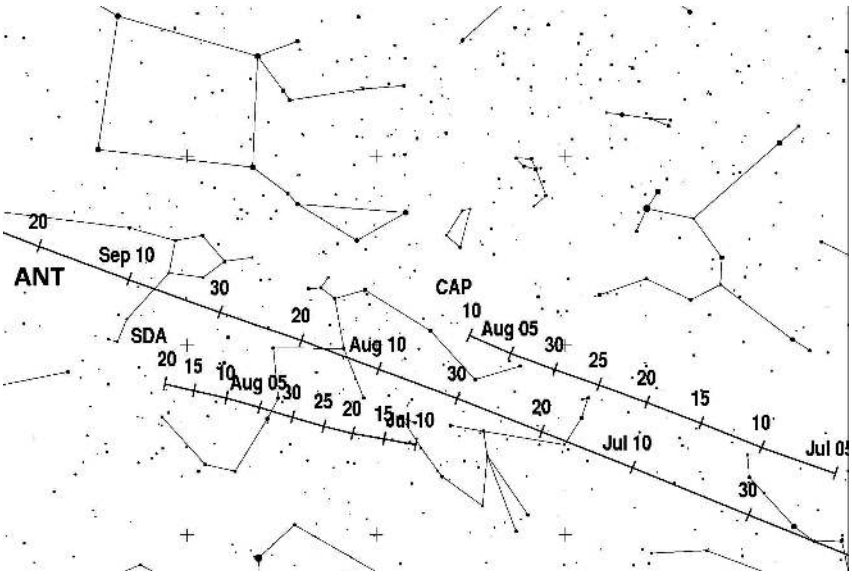
The orbit of the parent comet 7P/Pons-Winnecke (orbital period about 6.3 years, last perihelion passage on 2021 May 27) currently lies around 0.23 astronomical units outside the Earth's at its closest approach.

The 1998 and 2004 events resulted from meteoroids ejected from the comet in the past when the comet was still in a different orbit. For the 2026 return, there are no predictions of peculiar activity published. Nevertheless, we encourage all observers to monitor throughout the proposed period, in case of any activity. From mid-northerly latitudes the radiant is observable almost all night, but the prolonged – in some places continuous – twilight overnight keeps the useable time short. Koseki reported that recent video meteor observations of the SonotaCo and GMN show weak activity of the June-Boötids annually. A maximum occurs at $\lambda_\odot = 90\overset{\circ}{.}3$, i.e. 2026 June 22, 01$^{\rm h}$ UT with a radiant near $\alpha = 221°$, $\delta = +48°$. Activity from the radiant known from the 1998 and 2004 events is currently not observable. So observers should try to cover not only the given time but also the adjacent intervals.

5 July to September

The **ANT** is the chief focus for visual attention in the first half of July, as its radiant area moves steadily through eastern Sagittarius, then across northern Capricornus into southwest Aquarius (see chart below). ZHRs for most of the month should be ≈ 2 to 3. From around September 20, the **Southern Taurids (002 STA)** effectively take over the near-ecliptic activity from the ANT through to December (see chart on page 17).

Some weak activity **July Pegasids (175 JPE)** is possible around July 10. After mid-July the large ANT radiant area overlaps that of the minor **α-Capricornids (001 CAP)** into August, but the lower apparent velocity of the CAP allows observers to separate the two. The stronger and faster **Southern δ-Aquariids (005 SDA)** should be distinguishable from the ANT as well. The end-July period when the highest CAP and SDA rates are due, is close to Full Moon.



On 2016 July 28 at $00^{\rm h}07^{\rm m}$ UT ($\lambda_{\odot} = 125.^{\circ}132$) the **July γ-Draconids (184 GDR)** produced an outburst detected by radar and video observations. The same position is reached in 2026 on July 28 near $13^{\rm h}$ UT (this time close to the Full Moon). Although no extra activity was observed in 2017 – 2024, it may be worth checking because SonotaCo Network observations indicate that the GDR is an annual shower with a sharp but variable maximum from year to year (Koseki, 2020). The radiant of the slow meteors ($V_{\infty} = 27$ km/s) is at $\alpha = 280°$, $\delta = +51°$.

The **η-Eridanids (191 ERI)** are expected to reach a weak maximum around August 7. The next maximum is that of the **Perseids (007 PER)** on August 13, followed by the **κ-Cygnid (012 KCG)** activity. New Moon on August 12 provides good circumstances for the observation around the maxima of these three showers. Full Moon on August 28 will badly affect observations of the **Aurigid (206 AUR)** maximum in the night August 31 – September 1.

Model calculations of Maslov hint at possible weak activity of the **χ-Capricornids (420 CCA)** on September 9. The Earth may encounter dust released from comet 45P/Honda-Mrkos-Pajdušáková which is associated with the shower at $22^{\rm h}17^{\rm m}$ UT. Meteoroids should have left the comet at high ejection velocities to come close to the Earth's orbit. Therefore the number of visible meteors is expected to be low or even zero. Since there is no moonlight effect, it is worth checking what happens. The radiant of the fast meteors (65 km/s) is at $\alpha = 344°, \delta = -3°$.

Conditions are good to record the maximum of the **September ε-Perseids (208 SPE)** on September 9/10 and to check for any additional activity that may be possible, according to recent modelling (details on page 12).

The **ε-Eridanids (209 EER)** – not to be mixed up with the η-Eridanids (191 ERI) – seem to be related to comet C/1841 L1 Klinkerfues. The possible weak activity from the 1216 trail on 2025 September 12 mentioned in the previous Calendar still has to come. Since the period has no moonlight in 2026, it may be of interest to obtain some reference observations.

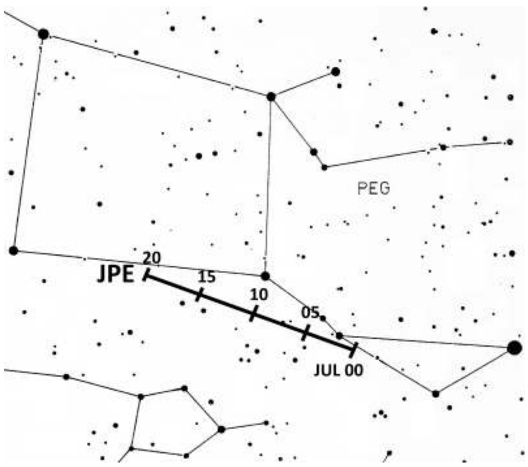
Activity from the region Auriga-Lynx should be recorded as **September Lyncids (081 SLY)** between mid September and mid October.

For **radio observers**, daytime activity decreases (see remarks to Table 7 on page 27). We may detect the **κ-Leonids (212 KLE)** at $\lambda_\odot = 183°$ (September 25) as another established daytime shower. The **Daytime Sextantid (221 DSX)** maximum follows at $\lambda_\odot = 188°$ (October 1). Very few meteors of this shower may also be detected by optical methods.

July Pegasids (175 JPE)

Active: July 1–20, Maximum: July 10, $\lambda_\odot = 108°$; ZHR = 3;
Radiant: $\alpha = 347°$, $\delta = 11°$; Radiant drift: see Table 6; $V_\infty = 63$ km/s; $r = 3.0$.

Meteors of this essentially northern shower have been observed repeatedly, and the shower was described in the 1995 edition of the IMO's Meteor Observer Handbook. Recent video meteor data (VID as well as Koseki, 2021) suggest an activity period which may extend well over the end given here, perhaps to end-July or into early August.

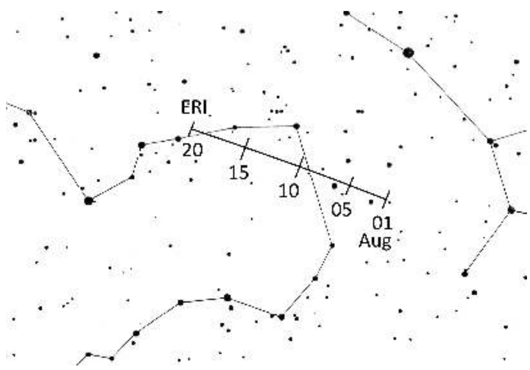


The radiant is above the horizon all night for observers at mid-northern latitudes, with conditions best after local midnight. Meteors of this shower appear fast. The Moon reaches its last quarter on July 7 so that most of the activity can be observed with no disturbances.

η-Eridanids (191 ERI)

Active: July 31–August 19; Maximum: August 07, $\lambda_\odot = 135°$; ZHR = 3;
Radiant: $\alpha = 41°$, $\delta = -11°$; Radiant drift: see Table 6; $V_\infty = 64$ km/s; $r = 3.0$.

The η-Eridanids (191 ERI) included in our working list recently may be associated with comet C/1852 K1 (Chacornac). The activity period given here has been adapted from Koseki (2021; pp. 140–141).

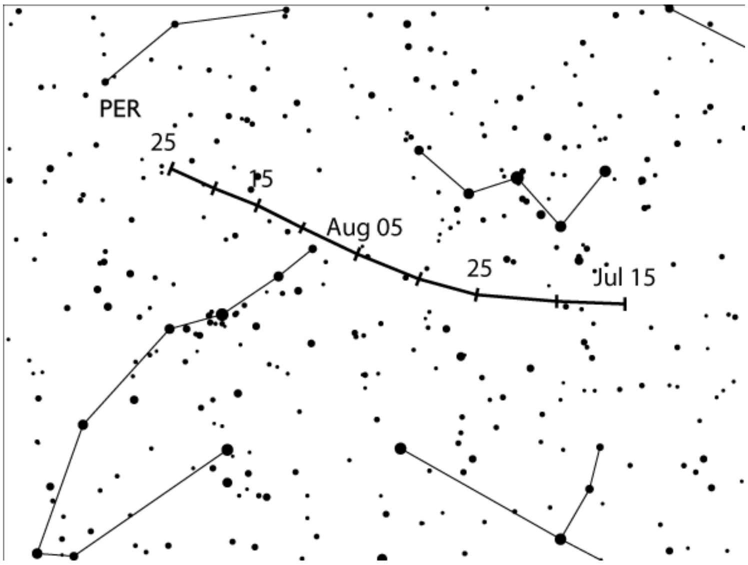


It seems that the activity continues long after its maximum which requires observational confirmation. The radiant of these fast meteors in the northwestern part of Eridanus is best observed after midnight, preferably from southern locations. The period after the tentative maximum can be used with no moonlight interference.

Perseids (007 PER)

Active: July 17–August 24; Maximum: August 13, 02^h to 04^h UT (node at $\lambda_\odot = 140\overset{\circ}{.}0 - 140\overset{\circ}{.}1$), but see text; ZHR = 100;
Radiant: $\alpha = 48°$, $\delta = +58°$; Radiant drift: see Table 6; $V_\infty = 59$ km/s; $r = 2.2$.

Previous IMO observations (see WB pp. 32–36) found the timing of the mean or 'traditional' broad maximum varied between $\lambda_\odot \approx 139\overset{\circ}{.}8$ to $140\overset{\circ}{.}3$, equivalent to 2026 August 12, 21^h – 09^h UT. The orbital period of the parent comet 109P/Swift-Tuttle is about 130 years. The Perseids produced strong activity from a primary maximum throughout the 1990s. Enhanced activity was last observed in 2016 due to passages through separated dust trails. High activity well after the main peak has been reported during some recent returns in 2018, 2020 and 2021 about 0.7 to 1.5 days after the main maximum. Nothing similar was observed in 2022—2024.



Maslov's modelling indicates that the background (permanent) activity is expected to be notably lower than the usually quoted ZHR of 100 until 2026. Only in 2027 will the Earth pass sections of the stream that have been disturbed by Jupiter once more, which may then cause higher general rates again.

Vaubaillon's calculations show an approach to the 1079 dust trail in 2026. The trail is split into three parts. The Earth is expected to encounter one of these branches on August 12 at 16^h53^m UT ($\lambda_\odot = 139\overset{\circ}{.}859$). Since it is a very old trail, no activity estimate is given.

An encounter of a weak filament of 109P is listed in Table 5d of Jenniskens (2006). The calculated position is $\lambda_\odot = 139\overset{\circ}{.}97 \pm 0\overset{\circ}{.}2$, corresponding to 2026 August 13, 01^hUT ($\pm 5^h$). The expected ZHR of ≤ 43 is similar to the calculated filaments in 2013, 2014 and 2025 ((the latter still to come when this Calendar was written). Although the calculated filament occurs close to the main maximum and only shortly after the above mentioned 1079 trail passage, the trail and filament may become detectable if the background rate is lower.

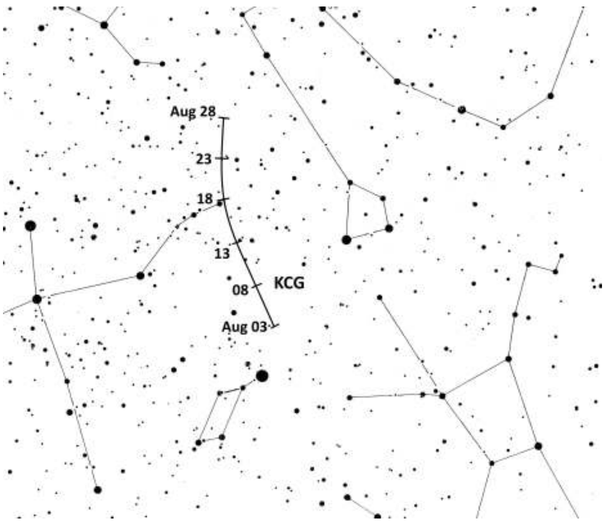
Since the trail and filament meteoroid size distribution may be different, it is advised to report also magnitude data for intervals of 30 minutes or less.

New Moon on August 12 provides excellent conditions for all optical observations. With all the extra events seen after the nodal peak during some past returns it is recommended to include the nights around the main maximum in the observing program to record peculiarities. Mid-northern latitude sites are best for Perseid observing, as from here, the radiant has reached a reasonable elevation from 22^h–23^h local time onwards. Regrettably, the shower cannot be properly viewed from most of the southern hemisphere, or from latitudes north of about 60°N.

κ-Cygnids (012 KCG)

Active: August 3–28; Maximum: August 17 ($\lambda_\odot = 144°$); ZHR = 3;
Radiant: $\alpha = 288°$, $\delta = +55°$; Radiant drift: see Table 6; $V_\infty = 23$ km/s; $r = 3.0$.

Enhanced κ-Cygnid activity was observed in 2007, 2014 and 2021 supporting an assumed 7-year period of the stream. This indicates that we do not expect enhanced rates in 2026.



An average flux density profile for the period 2012–2018 from video data shows a clear maximum at 144° and detectable activity between August 2 and September 3.

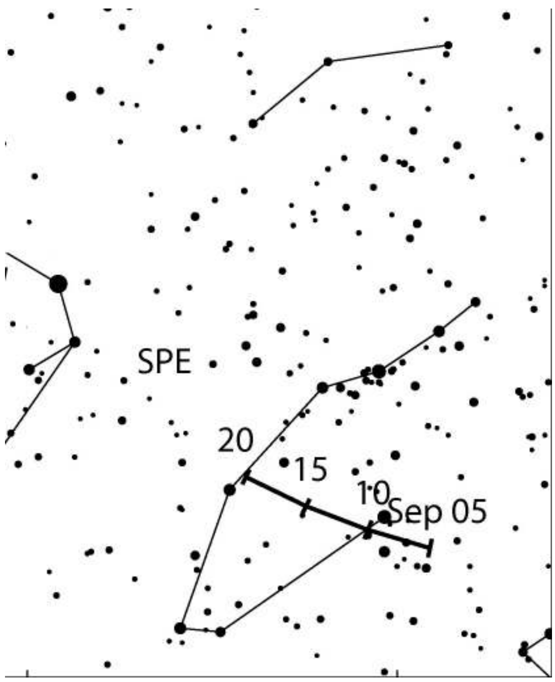
Research by Koseki (2014) has shown a complex radiant structure extending into Draco and Lyra. The isolated radiant position and the low velocity of the meteoroids should be used to associate KCG meteors to the complex assuming a slightly larger radiant area. The shower is best-observed from northern hemisphere sites, from where the radiant is easily available all night.

Visual observations are not suitable to distinguish between the sub-radiants identified with other techniques, but provide the total activity from radiants in the mentioned area.

September ε-Perseids (208 SPE)

Active: September 5–21; Maximum: September 9, 18^{h} UT ($\lambda_\odot = 166\overset{\circ}{.}7$), ZHR = 8;
Radiant: $\alpha = 48°$, $\delta = +40°$; Radiant drift: see Table 6; $V_\infty = 64$ km/s; $r = 2.5$.

This shower produced high rates on 2008 September 9, between roughly $\lambda_\odot = 166\overset{\circ}{.}894$–$166\overset{\circ}{.}921$, and another bright-meteor event with a very sharp peak at $\lambda_\odot = 167\overset{\circ}{.}188$ in 2013 but no later unambiguous increase subsequently. Generally, the shower is rich in bright meteors.



Sato (2025) and Vaubaillon (2025) ran model calculations assuming that meteoroids ejected from a parent object one orbital revolution ago caused the outburst observed in 2013. Sato adds that the assumption may be not valid because in 2018 no SPE activity was seen under similar conditions as for 2026. Vaubaillon notes that the bulk of this modelled trail will be well outside the Earth's orbit, and thus the possible activity should be low. All observations will thus be very important.

The assumed ejection years differ between the calculations, but all three modelling runs yield a possible encounter on 2026 September 10 near 06^h10^m UT:

Ejection year	Earth encounter 2026 UT	$\lambda_\odot$	Author and remarks
1583	06:09	167°199	Sato; 450yr orbital period
1085	06:10	167°200	Sato; 950yr orbital period
1848	06:13	167°200	Vaubaillon

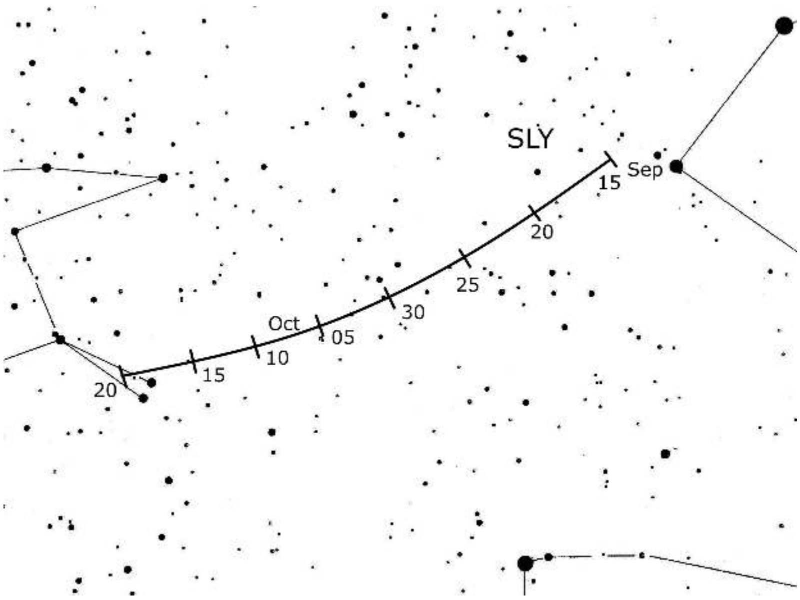
New Moon on September 11 provides optimal conditions to record data around the maximum and the possible encounter time of this primarily northern-hemisphere shower. The radiant area is well on-view all night from about 22^h–23^h local time for mid-northern locations.

September Lyncids (081 SLY)

Active: September 10–October 8; Maximum: September 13 ($\lambda_\odot = 170°$); ZHR $\approx 3 - 4$; Radiant: $\alpha = 113°$, $\delta = +56°$; Radiant drift: see Table 6; $V_\infty = 60$ km/s; $r = 3.0$.

There is easily detectable activity from the Lynx region after mid-September well into October. On 2023 September 25 close to 00^h30^m UT a short burst was observed. It was suggested that it could be associated with either the September Lyncids (081 SLY) or the β-Aurigids (210 BAU).

However, there is some confusion about the radiants and activity periods of some far northern showers not too far from the apex in this time. It seems that there are activities of at least two sources grouped together (Koseki, 2024). The first maximum occurs at $\lambda_\odot = 170°$ (Sep 13) and a weaker one at $\lambda_\odot = 192°$ (Oct 5). Further, the radiant centres are separated by about 15° in right ascension. The respective entries are also found in the entry for the 081 SLY in the IAU database.

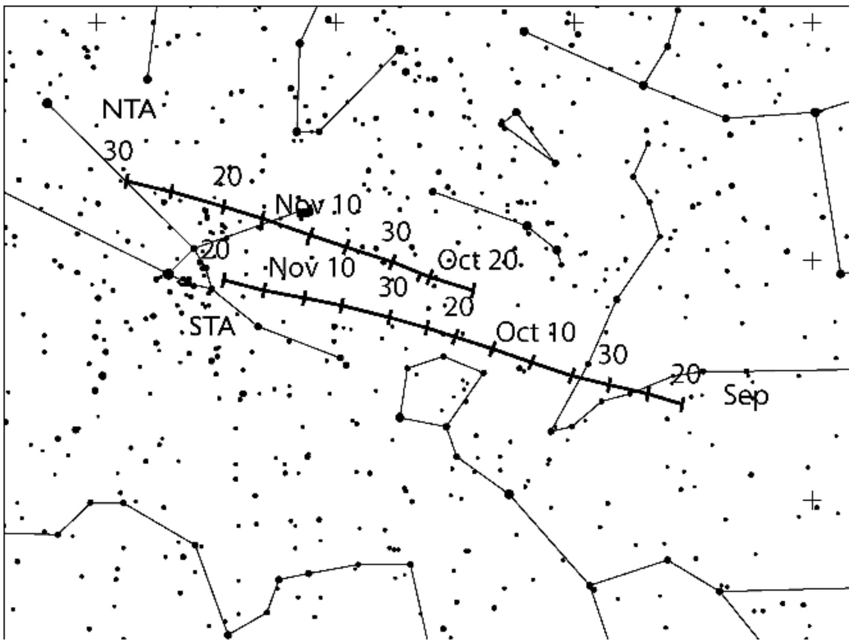


Due to the difficult case, we suggest that visual observers summarise the activity from this complex – which is close to the Earth's apex – under the label **September Lyncids (081 SLY)** applying the parameters given here and considering a radiant size of about 10°. The activity start is set to the end of the SPE period and may last until mid-October. We have to evaluate the case with more data and perhaps adjust the parameters.

6 October to December

The maxima of the **Orionids (008 ORI)** and **Leonids (013 LEO)** occur when the Moon is near its first quarter. There is only a waxing crescent at the **Geminid (004 GEM)** maximum while the **Ursids (015 URS)** reach their maximum on December 22, 22^{h}UT, two days before Full Moon. Jenniskens' (2006) Table 5b mentions a weak Ursid filament encounter on December 22 close to 14^{h}UT with a ZHR of less than 20. This comparable with filaments which were calculated for the returns in 2023 and 2024. The 96% illuminated Moon is in Taurus so that the chances for reliable optical data are small.

The two **Taurid** branches reach their highest rates around November 05 (Southern Taurids, 002 STA) and November 12 (Northern Taurids, 017 NTA), respectively, in a moon-free period. The **ANT** activity resumes only around December 10, as the Northern Taurids fade away. The radiant centre tracks from Taurus across southern Gemini during later December. The typical ZHR level is about 2.



Several minor showers are active in the last quarter of the year. The maximum of the **October Camelopardalids (281 OCT)** occurs on October 6, followed by the **October Draconids (009 DRA)** reach their maximum on October 9 – both under good circumstances. This also holds for the **ε-Geminids (023 EGE**, maximum October 18). Later, the **Leonis Minorids (022 LMI**, maximum on October 24) suffer from moonlight. This is also the case a month later for the **α-Monocerotids (246 AMO)**. There are no expectations for enhanced rates for the maximum on 2026 November 22. The maximum of the **November Orionids (250 NOO)** on November 28 is only four days after Full Moon.

In the past years, there were several activity signs from the **Andromedids (018 AND)** on 2021 November 28 and 2018 December 02. There is nothing predicted for the 2026 return. Modelling by Wiegert et al. (2013) gives higher rates for 2027. Nevertheless, observers might want to check for slow AND meteors. Recent analyses indicate that weak AND activity is observable annually. The radiant drifts significantly northwards in declination from end November to early December (Shiba, 2022). The very late part is listed as 446 DPC (December φ-Cassiopeids; activity observed in 2011). However, we recommend that visual observers report all meteors fitting the radiant and very low velocity (18 km/s) given in the short list below as 'AND'.

$\lambda_\odot$	Date	α	δ	Shower
230°	Nov 12	22°	+32°	AND
240°	Nov 22	24°	+41°	AND
250°	Dec 01	23°	+50°	AND
255°	Dec 06	20°	+55°	DPC

The maximum of the weak periodic **Phoenicids (254 PHO)** on December 2 coincides with the last quarter Moon. No peculiar activity is predicted for 2026. Observers are reminded, that in 2024 possible activity had been calculated to occur around mid-November from a radiant in Cetus (see IMO Shower Calendar 2024, p. 18).

The complex **Puppid-Velids (301 PUP**; reference date December 7) is well observable. This also holds for the **Monocerotids (019 MON)** and the **σ-Hydrids (016 HYD)** with their maxima on December 9.

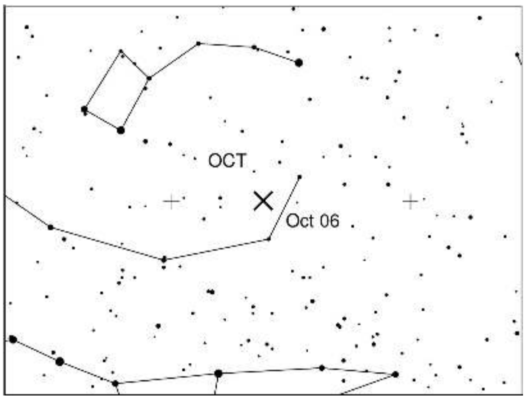
The maximum of the weak and long-lasting **Comae Berenicids (020 COM)** is due around or shortly before December 23. There are several showers with similar radiants and also orbital elements to the COM. Due to the complex situation (especially for the visual observer – see Rendtel, 2023) we suggest to summarise all meteors from the (extended) COM/DLM-region under "COM" for the entire activity period – see the description on page 21.

At the end of the year, the first **Quadrantids (010 QUA)** can be seen.

October Camelopardalids (281 OCT)

Active: October 5–6; Maximum: October 6, 04^h40^m ($\lambda_\odot = 192.°58$); ZHR = 5(?)
Radiant: $\alpha = 164°$, $\delta = 79°$; Radiant drift: negligible; $V_\infty = 47$ km/s; $r = 2.5$ (uncertain).

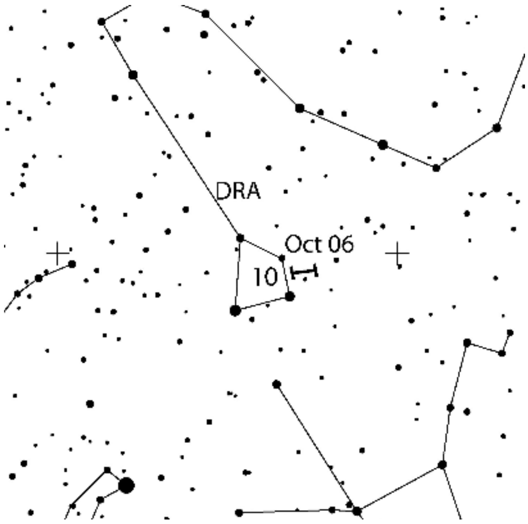
Activity from this north-circumpolar radiant was recorded annually since 2005, with a peak at $\lambda_\odot = 192.°58$. By assuming a long-period parent object, and using the well-documented 2005 outburst as its reference point, Esko Lyytinen calculated that there might be detectable visual activity near $\lambda_\odot = 192.°529$ in 2018 and 2019. In both years, some activity was indeed recorded, with a slightly higher rate on 2018 October 6, 00^h30^mUT $\pm$ 1.3^h ($192.°45 \pm 0.°05$; ZHR $\approx$ 5). Surprises are possible because the stream is either a long-period one with an atypically wide 1-revolution trail, or we are still to encounter the densest part of the trail. However, for 2026 no activity prediction has been issued.



Draconids (009 DRA)

Active: October 6–10; Maximum: October 9, 01^h UT ($\lambda_\odot = 195.°4$); ZHR = 5 (?);
Radiant: $\alpha = 263°$, $\delta = +56°$; Radiant drift: negligible; $V_\infty = 20$ km/s; $r = 2.6$.

Perfectly moonless observing conditions for the October Draconids allow the recording of data during their entire activity period this year. The radiant is north-circumpolar for latitudes north of about 45°N. Draconid meteors are exceptionally slow-moving.

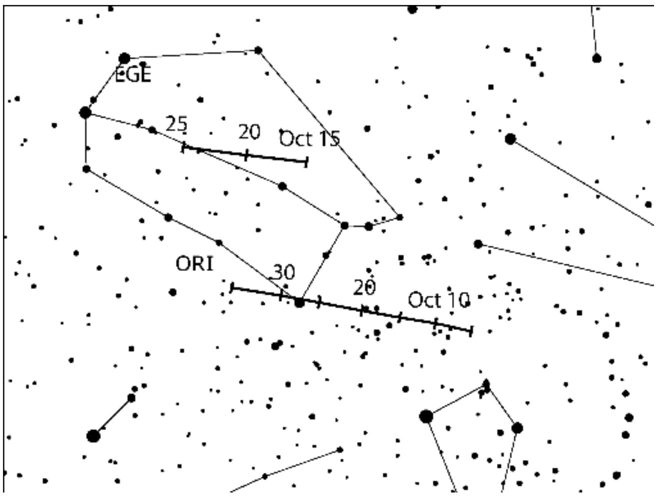


The shower produced spectacular meteor storms in 1933 and 1946, and enhanced but lower rates in several other years (ZHRs ≈ 20–500+). Recent outbursts happened in 2011 (ZHR ≈ 300; predicted) and in 2012 (rich in faint radar meteors; unexpected). The 2018 return yielded a ZHR of about 150 persisting for about 4 hours. For the 2026 return there are no predictions of enhanced rates.

The parent comet 21P/Giacobini-Zinner passed its perihelion on 2025 March 25. Like in 2025, we advise observers to pay attention to a period about 24 hours around the given nodal crossing time as there may be meteors from old dust trails which produce no significant rates alone but perhaps will cause some detectable activity.

ε-Geminids (023 EGE)

Active: October 14–27; Maximum: October 18 ($\lambda_\odot = 205°$); ZHR = 3;
Radiant: $\alpha = 102°$, $\delta = +27°$; Radiant drift: see Table 6;
$V_\infty = 70$ km/s; $r = 3.0$.



A weak minor shower with characteristics and activity nearly coincident with the Orionids, so great care must be taken to separate meteors of the two sources. First Quarter Moon on October 18 leaves the second half of the night with high radiant elevation undisturbed. Northern observers have a radiant elevation advantage and can observe from about local midnight onwards. There is still some uncertainty about the shower's parameters. Both visual and video data indicate that the maximum may be later than listed; at least it is not well defined with ZHRs of about 3 for more than one day.

Orionids (008 ORI)

Active: October 2–November 7; Maximum: October 21 ($\lambda_\odot = 208°$); ZHR = 20+;
Radiant: $\alpha = 95°$, $\delta = +16°$; Radiant drift: see Table 6;
$V_\infty = 66$ km/s; $r = 2.5$.

The shower's radiant (see chart in the preceding EGE section) is at a useful elevation from local midnight or so in either hemisphere, somewhat before in the north. The waxing moon leaves some moon-free hours at least until the maximum of the shower.

Each return from 2006 to 2009 produced unexpectedly strong ZHRs of around 40–70 on two or three consecutive dates. An earlier IMO analysis of the shower, using data from 1984–2001, found both the peak ZHR and r parameters varied somewhat from year to year, with the highest mean ZHR ranging from $\approx$ 14–31 during the examined interval.

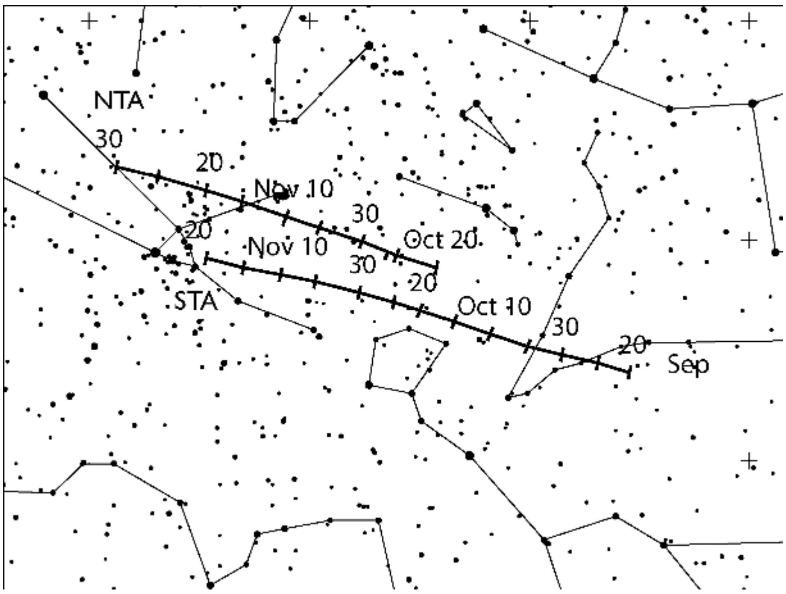
A suspected 12-year periodicity in stronger returns claimed earlier in the 20th century is not detectable from visual data but seems to occur in CMOR radar data since 2002 (Egal et al., 2020). Higher activity due to the suspected cycle was mentioned for the period between 2020–2022 in previous calendars. The average maximum Orionid ZHRs in the years 2012–2020 was in the range of 20–30. The available data does not allow us to draw a conclusion about the periodicity question.

The Orionids may also provide several lesser maxima and sometimes the activity may be similar for several consecutive nights centred on the main peak.

Southern Taurids (002 STA)

Active: September 20–November 20; Maximum: November 05 ($\lambda_\odot = 223°$); ZHR = 5–10; Radiant: $\alpha = 52°$, $\delta = +15°$; Radiant drift: see Table 6; $V_\infty = 27$ km/s; $r = 2.3$.

This stream, with its Northern counterpart, forms part of the complex associated with Comet 2P/Encke. Observers find a superposition of activities. For shower association, assume the radiant to be an oval area, about 20° in α by 10° in δ, centred on the radiant position for any given date. Its near-ecliptic radiant makes the shower a target for observers at all latitudes, albeit those in the northern hemisphere are somewhat better-placed, as here suitable radiant zenith distances persist for much of the night.



The Taurid activity overall dominates the Antihelion Source area's during the northern autumn, so much so that the ANT is considered inactive while either branch of the Taurids is present. The brightness and relative slowness of many Taurid meteors makes them ideal targets for still-imaging, while these factors coupled with low, steady, Taurid rates makes them excellent subjects for newcomers to practice their visual plotting techniques. The main maximum (ZHR 5–10) of the STA is found around November 05, but there is an early maximum (ZHR near 5) around October 13 – a date which often was listed as actual STA maximum. There are several components contributing to the STA activity. Koseki remarks that the activity around the October-maximum may be somewhat higher than the average in 2026.

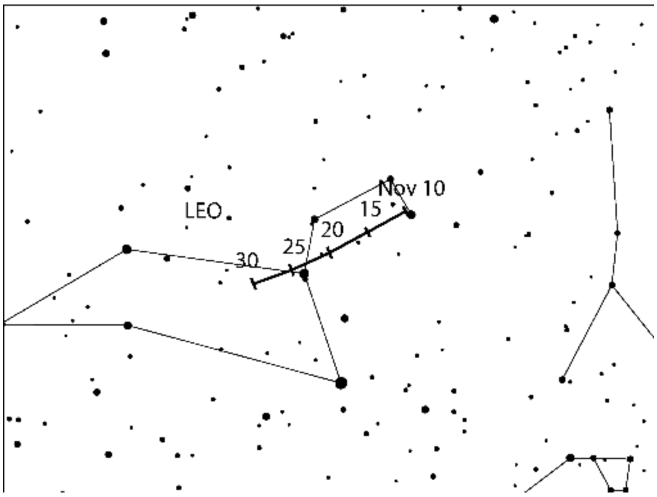
Northern Taurids (017 NTA)

Active: October 20–December 10; Maximum: November 12 ($\lambda_\odot = 230°$); ZHR = 5;
Radiant: $\alpha = 58°$, $\delta = +22°$; Radiant drift: see Table 6; $V_\infty = 29$ km/s; $r = 2.3$.

The large, oval radiant region to be used for shower association, the shower's excellent visibility overnight, and its dominance over the ANT during September to December are essentially the same as discussed in the STA section above. As previous results had suggested seemingly plateau-like maximum rates persisted for roughly ten days in early to mid November, the NTA peak may not be so sharp as its single maximum date might imply. New Moon on November 9 allows undisturbed optical observations especially in the period between the dates given as maxima of the two Taurid branches.

Leonids (013 LEO)

Active: November 6–30; Maximum: November 17, 23^h45^m UT (nodal crossing at $\lambda_\odot = 235{.}^\circ27$), but see text; ZHR ≈ 15
Radiant: $\alpha = 152°$, $\delta = +22°$; Radiant drift: see Table 6; $V_\infty = 71$ km/s; $r = 2.5$.



The regular nodal Leonid maximum at $\lambda_\odot = 235{.}^\circ27$ should occur on 2026 November 17 at 23^h45^m UT. Maslov (2007) gives 2026 November 17, 16^h UT (i.e. $\lambda_\odot = 234{.}^\circ95$) with an expected ZHR of about 15. The next perihelion of the Leonids' parent comet, 55P/Tempel-Tuttle, is due on 2031 May 20. Hence, the meteoroids we observe now are ahead of the comet.

Model calculations of Vaubaillon (2025) and Sato (2025) show that there should be several encounters with trails of low densities.

The calculated times in 2026 are:

Date	UT	$\lambda_\odot$	Ejection	Author and comment
Nov 17	10:33	$234{.}^\circ716$	1533	weak; Sato
Nov 18	21:55	$236{.}^\circ202$	1800	low level; Vaubaillon
Nov 19	03:31	$236{.}^\circ438$	1699	weak; Sato
Nov 19	03:52	$236{.}^\circ452$	1699	low level; Sato
Nov 19	16:26	$236{.}^\circ981$	1600	weak; Sato
Nov 19	16:42	$231{.}^\circ992$	1600	very weak; Vaubaillon

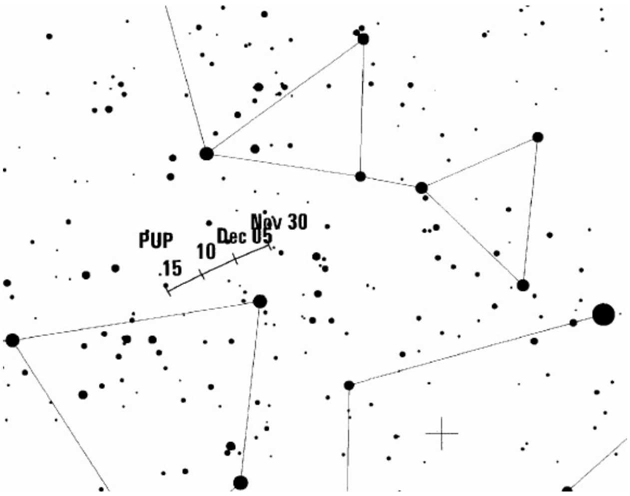
Notes by Vaubaillon (2025): the 1800 dust trail makes it to the Earth, but the number of meteoroids will not be sufficient for a significant outburst. The older and split trail of 1600 also comes close to the Earth but the distance is too large to cause significant activity.

Notes by Sato (2025): the trails have low dust densities. Lower ejection velocities compared to similar cases in recent years may imply a modest increase of meteor activity.

Puppid-Velids (301 PUP)

Active: December 1–15(?); Maximum: December ≈ 7 ($\lambda_\odot \approx 255^\circ$); ZHR ≈ 10;
Radiant: $\alpha = 123^\circ$, $\delta = -45^\circ$; Radiant drift: see Table 6; $V_\infty = 44$ km/s; $r = 2.9$.

The Puppid-Velids is a traditional designation for a system of poorly-studied showers (see, e.g. Jenniskens 2006, p. 517). It is visible chiefly from locations south of the equator.



The designation 301 PUP which we use here represents an "average" position which is close to the 746 EVE (e-Velids). The radiants summarised here as PUP are tightly clustered so that visual observing cannot separate them. The activity is not well established, though slightly higher rates seem to occur in early to mid December and perhaps around December 20 again (then being close to a radiant which is given as 784 KVE (κ-Velids) in the IAU database. There are more weak showers listed in the database, extending activity possibly into January – close to the detection threshold and thus not listed here.

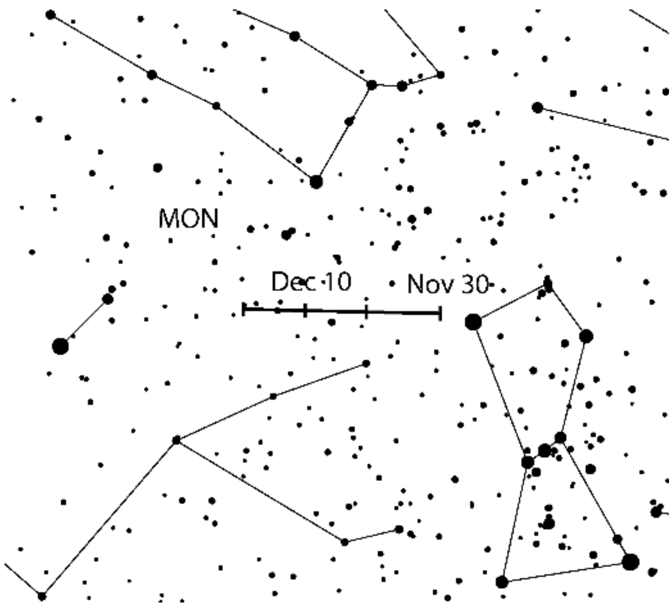
All this has "working" status and needs further investigation. New Moon on Decmber 9 allows monitoring the activity during the period mentioned here. The radiant area is on-view all night from tropical and southern locations, highest towards dawn. Visual observers should consider an extended radiant size (as for example in the case of the κ-Cygnids in August). Occasional bright fireballs, notably around the suggested maximum, have been reported.

Monocerotids (019 MON)

Active: December 1–December 19; Maximum: December 9 ($\lambda_\odot = 257^\circ$); ZHR = 3;
Radiant: $\alpha = 100^\circ$, $\delta = +08^\circ$; Radiant drift: see Table 6; $V_\infty = 41$ km/s; $r = 3.0$.

This shower (also called December Monocerotids) is well known for a long time, but the amount of data is not sufficient to investigate details. In most years, visual data give a maximum ZHR = 3 at $\lambda_\odot \approx 257^\circ$ while the general ZHR level is about 2. In a few years, we also find an apparent slight enhancement in the Geminid peak night – perhaps an effect of Geminids erroneously classified as MON.

Video data (2011–2022) show a peak of roughly $0\overset{\circ}{.}4$ width centred at $\lambda_\odot \approx 262^\circ$ (i.e. December 14) with a ZHR of the order of 8 coinciding with the Geminid peak. A much weaker ZHR ≈ 3 appears near $\lambda_\odot = 255\overset{\circ}{.}5$. This still needs to be clarified.

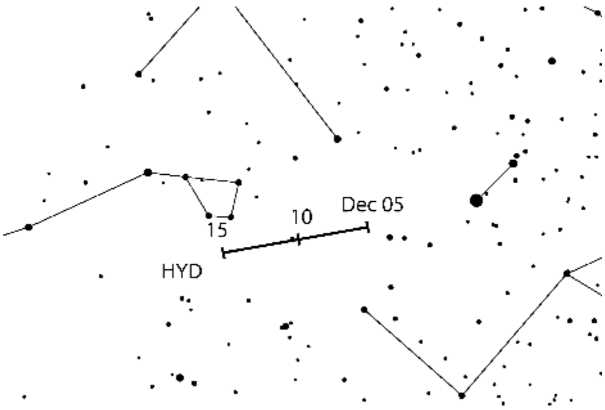


Care needs to be taken to clearly distinguish MON from GEM and NOO. Visual observers should choose their field of view such that the radiants do not line up. (Field centres north of Taurus in the evening or near Leo in the morning are possible choices.) The radiant area is available virtually all night for much of the globe, culminating at about 01^h30^m local time.

σ-Hydrids (016 HYD)

Active: December 3–20; Maximum: December 9 ($\lambda_\odot = 257°$); ZHR = 7;
Radiant: $\alpha = 125°$, $\delta = +02°$; Radiant drift: see Table 6; $V_\infty = 58$ km/s; $r = 3.0$.

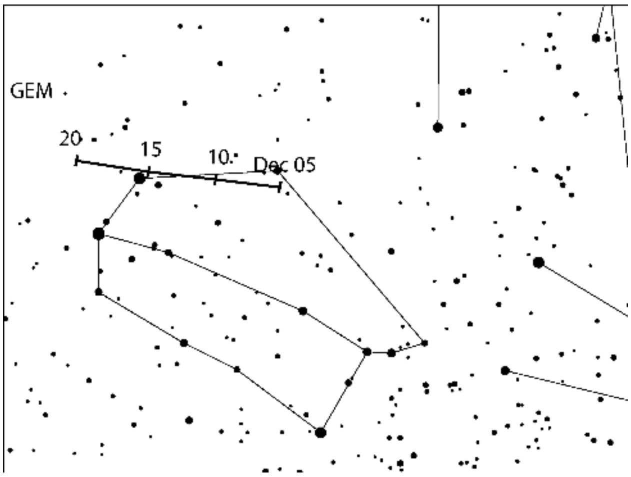
The σ-Hydrids are often thought to be a very minor shower with rates close to the visual detection threshold for much of the activity period. However, some bright meteors are repeatedly seen and the maximum ZHR reliably reaches 5–8. A maximum occasionally found nearer $\lambda_\odot \approx 262°$ (December 14) is probably caused by mis-aligned Geminids as described for the MON.



Visual IMO data from the period 2010–2021 show a maximum at $\lambda_\odot = 257° - 258°$ (December 9–10). Video data from 2010–2021 indicate a peak at $\lambda_\odot \approx 255\overset{\circ}{.}5$ (December 6), and that HYD activity might persist till December 24. A careful choice of the observing field is necessary to distinguish HYD from GEM and MON which are active at the same time (see notes in the MON section above). Since the HYD radiant rises in the late evening hours, it is best viewed after local midnight from either hemisphere.

Geminids (004 GEM)

Active: December 4–20; Maximum: December 14, 14^h UT ($\lambda_\odot = 262\overset{\circ}{.}2$); ZHR = 150;
Radiant: $\alpha = 112°$, $\delta = +33°$; Radiant drift: see Table 6;
$V_\infty = 35$ km/s; $r = 2.6$.



The best and most reliable of the major annual showers presently observable reaches its broad moon-free maximum on December 14 centred at 14^h UT. The shower is known for bright meteors and fireballs.

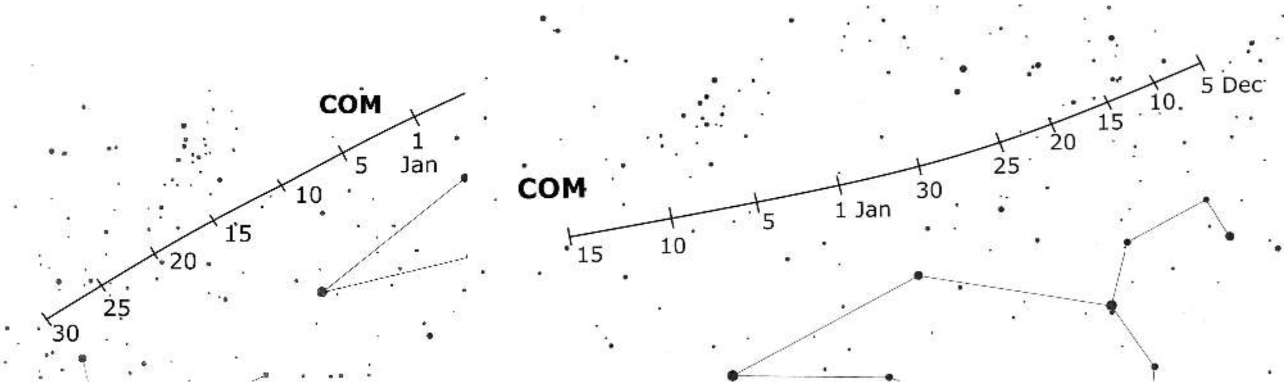
Well north of the equator, the radiant rises about sunset, reaching a usable elevation already from the local evening hours onwards. Observing locations at middle and northern latitudes are best suited. In the southern hemisphere, the radiant appears only around local midnight or so. It culminates near 02^h local time.

The peak has shown little variability in its timing in recent years, with the more reliably-reported maxima during the past two decades (WB, p. 66) all having occurred within $\lambda_{\odot} = 261\overset{\circ}{.}5$ to $262\overset{\circ}{.}4$, that is 2026 December 13, 21^{h} to December 14, 18^{h} UT.

The Geminids are known for their broad maximum, producing ZHR of 100 and more over roughly 10–12 hours. During most returns a mass sorting was observed: there is a larger portion of bright Geminids towards the end of the main maximum period. Since the Geminids are on a short-period orbit, relatively rapid changes may happen. So all observations of each return may help to follow and understand the evolution of this unique stream. Around the maximum observers should report their rate and magnitude data for short intervals (no longer than 15 minutes).

Comae Berenicids (020 COM)

Active: December 4–January 30; Maximum: December 23 ($\lambda_{\odot} = 271°$); ZHR $= 2 - 3$;
Radiant: $\alpha = 164°$, $\delta = +29°$; Radiant drift: see Table 6;
$V_{\infty} = 65$ km/s; $r = 3.0$.



For many years, we listed two meteor showers in our working list: the Comae Berenicids (020 COM) and the December Leonis Minorids (032 DLM) between early December to early February. The data, however, was not consistent as there are more radiants in the IAU database with similar showers (Rendtel & Molau, 2022). For the visual observer it is not possible to distinguish between these showers. Therefore, we recommend to summarise activity associated with radiants in the region north of Leo as Comae Berenicids (COM). We consider $\lambda_{\odot} = 271°$ (December 23) as the reference value.

Visual data of December 2019, 2020 and 2021 show no significant rate variation, but a trend to slightly higher ZHRs around December 20–23 similar to the video data. At this time, the (mean) radiant position is at $\alpha = 164°$, $\delta = +29°$. This is less than 3° south of the star ξ Ursae Majoris. Nevertheless, we keep the designation COM.

Video meteor activity data and visual ZHR data suggest that the COM activity is most obvious between December 17 and 29 ($\lambda_{\odot} = 265 - 277°$). Overall, meteors from this region are detectable from December 4 ($\lambda_{\odot} = 251°$) until January 31 ($\lambda_{\odot} = 311°$).

7 Radiant sizes and meteor plotting for visual observers

by Rainer Arlt

If you are not observing during a major-shower maximum, it is essential to associate meteors with their radiants correctly, since the total number of meteors will be small for each source. Meteor plotting allows shower association by more objective criteria after your observation than the simple imaginary back-prolongation of paths under the sky. With meteors plotted on gnomonic maps, you can trace them back to their radiants by extending their straight line paths. If a radiant lies on another chart, you should find common stars on an adjacent chart to extend this back-prolongation correctly.

How large a radiant should be assumed for shower association? The real physical radiant size is very small, but visual plotting errors cause many true shower meteors to miss this real radiant area. Thus we have to assume a larger effective radiant to allow for these errors. Unfortunately, as we enlarge the radiant, so more and more sporadic meteors will appear to line up accidentally with this region. Hence we have to apply an optimum radiant diameter to compensate for the plotting errors loss, but which will not then be swamped by sporadic meteor pollution. Table 1 gives this optimum diameter as a function of the distance of the meteor from the radiant.

Table 1. Optimum radiant diameters to be assumed for shower association of minor-shower meteors as a function of the radiant distance D of the meteor.

D	optimum diameter
15°	14°
30°	17°
50°	20°
70°	23°

Note that this radiant diameter criterion applies to all shower radiants *except* those of the Southern and Northern Taurids, and the Antihelion Source. The optimum $\alpha \times \delta$ size to be assumed for the STA and NTA is instead $20^\circ \times 10^\circ$, while that for the ANT is still larger, at $30^\circ \times 15^\circ$. In a few cases, we add information about radiant extensions in the shower descriptions.

Path-direction is not the only criterion for shower association. The angular velocity of the meteor should match the expected speed of the given shower meteors according to their geocentric velocities. Angular velocity estimates should be made in degrees per second (°/s). To do this, make the meteors you see move for one second in your imagination at the speed you saw them. The path length of this imaginary meteor is the angular velocity in °/s. Note that typical speeds are in the range 3°/s to 25°/s. Typical errors for such estimates are given in Table 2.

Table 2. Error limits for the angular velocity.

angular velocity [°/s]	5	10	15	20	30
permitted error [°/s]	3	5	6	7	8

If you find a meteor in your plots which passes the radiant within the diameter given by Table 1, check its angular velocity. Table 3 gives the angular speeds for a few geocentric velocities, which can then be looked up in Table 5 for each shower.

Table 3. Angular velocities as a function of the radiant distance of the meteor (D) and the elevation of the meteor above the horizon (h) for three different geocentric velocities (V_∞). All velocities are in °/s.

	$V_\infty = 25$ km/s					$V_\infty = 40$ km/s					$V_\infty = 60$ km/s				
$h\backslash D$	10°	20°	40°	60°	90°	10°	20°	40°	60°	90°	10°	20°	40°	60°	90°
10°	0.4	0.9	1.6	2.2	2.5	0.7	1.4	2.6	3.5	4.0	0.9	1.8	3.7	4.6	5.3
20°	0.9	1.7	3.2	4.3	4.9	1.4	2.7	5.0	6.8	7.9	1.8	3.5	6.7	9.0	10
40°	1.6	3.2	5.9	8.0	9.3	2.6	5.0	9.5	13	15	3.7	6.7	13	17	20
60°	2.2	4.3	8.0	11	13	3.5	6.8	13	17	20	4.6	9.0	17	23	26
90°	2.5	4.9	9.3	13	14	4.0	7.9	15	20	23	5.3	10	20	26	30

8 References and Abbreviations

References:

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Abbreviations and symbols:

$\boldsymbol{\alpha}$, $\boldsymbol{\delta}$: Coordinates for a shower's radiant position, usually at maximum. $\boldsymbol{\alpha}$ is right ascension, δ is declination. Radiants drift across the sky each day due to the Earth's own orbital motion around the Sun, and this must be allowed for using the details in Table 6 for nights away from the listed shower maxima.

$\boldsymbol{r}$: The population index, a term computed from each shower's meteor magnitude distribution. $r = 2.0 - 2.5$ implies a larger fraction of brighter meteors than average, while r above 3.0 is richer in fainter meteors than average.

$\boldsymbol{\lambda_\odot}$: Solar longitude, a precise measure of the Earth's position on its orbit which is not dependent on the vagaries of the calendar. All $\lambda_\odot$ are given for the equinox 2000.0.

$\boldsymbol{V_\infty}$: Pre-atmospheric or apparent meteoric velocity, given in km/s. Velocities range from about 11 km/s (very slow) to 72 km/s (very fast). 40 km/s is roughly medium speed.

ZHR: Zenithal Hourly Rate, a calculated maximum number of meteors an ideal observer would see in perfectly clear skies (reference limiting magnitude +6.5) with the shower radiant overhead. This figure is given in terms of meteors per hour.

9 Tables: lunar and shower data

Table 4. Lunar phases for 2026.

New Moon	First Quarter	Full Moon	Last Quarter
		January 3	January 10
January 18	January 26	February 1	February 9
February 17	February 24	March 3	March 11
March 19	March 25	April 2	April 10
April 17	April 24	May 1	May 9
May 16	May 23	May 31	June 8
June 15	June 21	June 30	July 7
July 14	July 21	July 29	August 6
August 12	August 20	August 28	September 4
September 11	September 18	September 26	October 3
October 10	October 18	October 26	November 1
November 9	November 17	November 24	December 1
December 9	December 17	December 24	December 30

Table 5. Working List of Visual Meteor Showers. Details in this Table were correct according to the best information available in June 2025, with maximum dates accurate only for 2026. The parenthesized maximum date for the Puppids-Velids indicates a reference date for the radiant only, not necessarily a true maximum. The given ZHR is based on recent observed returns. Possibly periodic showers are noted as 'Var' = variable. For more information check the updates published e.g. in the IMO Journal *WGN*.

Shower	Activity	Maximum Date	Maximum $\lambda_\odot$	Radiant α	Radiant δ	V_∞ km/s	r	ZHR
Antihelion Source (ANT)	Dec 10–Sep 20 –	March–April, late May, late June		see Table 6		30	3.0	4
Quadrantids (010 QUA)	Dec 28–Jan 12	Jan 03	283.°15	230°	+49°	41	2.1	80
γ-Ursae Minorids (404 GUM)	Jan 10–Jan 22	Jan 18	298°	228°	+67°	31	3.0	3
α-Centaurids (102 ACE)	Jan 31–Feb 20	Feb 08	319.°4	211°	−58°	58	2.0	6
April Lyrids (006 LYR)	Apr 14–Apr 30	Apr 22	32.°32	271°	+34°	49	2.1	18
π-Puppids (137 PPU)	Apr 15–Apr 28	Apr 24	33.°5	110°	−45°	18	2.0	Var
η-Aquariids (031 ETA)	Apr 19–May 28	May 06	45.°5	338°	−01°	66	2.4	50
η-Lyrids (145 ELY)	May 03–May 14	May 11	50.°0	291°	+43°	43	3.0	3
Dayt. Arietids (171 ARI)	May 14–Jun 24	Jun 07	76.°7	43°	+24°	38	2.8	30
June Bootids (170 JBO)	Jun 22–Jul 02	Jun 22	90.°3	221°	+48°	18	2.2	Var
July Pegasids (175 JPE)	Jul 01–Jul 20	Jul 10	108.°0	347°	+11°	63	3.0	3
July γ-Draconids (184 GDR)	Jul 25–Jul 31	Jul 28	125.°13	280°	+51°	27	3.0	5
S. δ-Aquariids (005 SDA)	Jul 12–Aug 23	Jul 31	128°	340°	−16°	41	2.5	25
α-Capricornids (001 CAP)	Jul 03–Aug 15	Jul 31	128°	307°	−10°	23	2.5	5
η-Eridanids (191 ERI)	Jul 31–Aug 19	Aug 07	135°	41°	−11°	64	3.0	3
Perseids (007 PER)	Jul 17–Aug 24	Aug 13	140.°0	48°	+58°	59	2.2	100
κ-Cygnids (012 KCG)	Aug 03–Aug 28	Aug 17	144°	286°	+59°	23	3.0	3
Aurigids (206 AUR)	Aug 28–Sep 05	Sep 01	158.°6	91°	+39°	66	2.5	6
Sep. ε-Perseids (208 SPE)	Sep 05–Sep 21	Sep 09	166.°7	48°	+40°	64	2.5	8
Sep. Lyncids (081 SLY)	Sep 10–Oct 08	Sep 13	170°	113°	+56°	60	3.0	3
Dayt. Sextantids (221 DSX)	Sep 20–Oct 06	Oct 01	188°	156°	−02°	32	2.5	5
Oct. Camelopard. (281 OCT)	Oct 05–Oct 06	Oct 06	192.°58	164°	+79°	47	2.5	5
Draconids (009 DRA)	Oct 06–Oct 10	Oct 09	195.°4	262°	+54°	20	2.6	5
ε-Geminids (023 EGE)	Oct 14–Oct 27	Oct 18	205°	102°	+27°	70	3.0	3
Orionids (008 ORI)	Oct 02–Nov 07	Oct 21	208°	95°	+16°	66	2.5	20
Leonis Minorids (022 LMI)	Oct 19–Oct 27	Oct 24	211°	162°	+37°	62	3.0	2
S. Taurids (002 STA)	Sep 20–Nov 20	Nov 05	223°	52°	+15°	27	2.3	7
N. Taurids (017 NTA)	Oct 20–Dec 10	Nov 12	230°	58°	+22°	29	2.3	5
Leonids (013 LEO)	Nov 06–Nov 30	Nov 17	235.°27	152°	+22°	71	2.5	15
α-Monocerotids (246 AMO)	Nov 15–Nov 25	Nov 22	239.°32	117°	+01°	65	2.4	Var
Nov. Orionids (250 NOO)	Nov 13–Dec 06	Nov 28	246°	91°	+16°	44	3.0	3
Phoenicids (254 PHO)	Dec 01–Dec 05	Dec 02	249.°5	08°	−27°	15	2.8	Var
Puppid-Velids (301 PUP)	Dec 01–Dec 15	(Dec 07)	(255°)	123°	−45°	44	2.9	10
Monocerotids (019 MON)	Dec 01–Dec 19	Dec 09	257°	100°	+08°	41	3.0	3
σ-Hydrids (016 HYD)	Dec 03–Dec 20	Dec 09	257°	125°	+02°	58	3.0	7
Geminids (004 GEM)	Dec 04–Dec 20	Dec 14	262.°2	112°	+33°	35	2.6	150
Comae Berenicids (020 COM)	Dec 04–Jan 30	Dec 23	271°	164°	+29°	65	3.0	3
Ursids (015 URS)	Dec 17–Dec 26	Dec 22	270.°7	217°	+76°	33	2.8	10

Table 6 (next page). **Radiant positions during the year in α and δ.**

Date		ANT		QUA		COM								
Jan	0	112°	+21°	228°	+50°	172°	+25°							
Jan	5	117°	+20°	231°	+49°	176°	+24°			**GUM**				
Jan	10	122°	+19°	234°	+48°	180°	+23°			220°	+71°			
Jan	15	127°	+17°			185°	+21°			224°	+69°			
Jan	20	132°	+16°			189°	+19°			228°	+67°			
Jan	25	138°	+15°			194°	+17°	**ACE**		232°	+65°			
Jan	30	143°	+13°			198°	+16°	199°	−56°					
Feb	5	149°	+11°					206°	−58°					
Feb	10	154°	+9°					213°	−59°					
Feb	15	159°	+7°					219°	−61°					
Feb	20	164°	+5°					224°	−62°					
Feb	28	172°	+2°											
Mar	5	177°	0°											
Mar	10	182°	−2°											
Mar	15	187°	−4°											
Mar	20	192°	−6°											
Mar	25	197°	−7°											
Mar	30	202°	−9°											
Apr	5	208°	−11°											
Apr	10	213°	−13°	**LYR**		**PPU**								
Apr	15	218°	−15°	263°	+34°	106°	−44°	**ETA**						
Apr	20	222°	−16°	269°	+34°	109°	−45°	323°	−7°					
Apr	25	227°	−18°	274°	+34°	111°	−45°	328°	−5°					
Apr	30	232°	−19°	279°	+34°			332°	−3°	**ELY**				
May	05	237°	−20°					337°	−1°	286°	+43°			
May	10	242°	−21°					341°	+1°	291°	+43°			
May	15	247°	−22°					345°	+3°	296°	+44°			
May	20	252°	−22°					349°	+5°					
May	25	256°	−23°					353°	+7°					
May	30	262°	−23°	**ARI**										
Jun	5	267°	−23°	42°	+24°									
Jun	10	272°	−23°	47°	+24°									
Jun	15	276°	−23°											
Jun	20	281°	−23°	**JBO**										
Jun	25	286°	−22°	221°	+48°									
Jun	30	291°	−21°	222°	+47°	**CAP**						**JPE**		
Jul	5	296°	−20°			285°	−16°	**SDA**				343°	+10°	
Jul	10	300°	−19°	**PER**		289°	−15°	325°	−19°			347°	+11°	
Jul	15	305°	−18°	6°	+50°	294°	−14°	329°	−19°			351°	+12°	
Jul	20	310°	−17°	11°	+52°	299°	−12°	333°	−18°			356°	+13°	**GDR**	
Jul	25	315°	−15°	22°	+53°	303°	−11°	337°	−17°					277°	+51°
Jul	30	319°	−14°	29°	+54°	307°	−10°	340°	−16°	**ERI**		**KCG**		282°	+51°
Aug	5	325°	−12°	37°	+56°	313°	−8°	345°	−14°	39°	−14°	281°	+45°		
Aug	10	330°	−10°	45°	+57°	318°	−6°	349°	−13°	44°	−12°	284°	+49°		
Aug	15	335°	−8°	51°	+58°			352°	−12°	48°	−10°	287°	+53°		
Aug	20	340°	−7°	57°	+58°	**AUR**		356°	−11°	52°	−9°	289°	+56°		
Aug	25	344°	−5°	63°	+58°	85°	+40°					291°	+59°		
Aug	30	349°	−3°			90°	+39°	**SPE**				293°	+62°		
Sep	5	355°	−1°			96°	+39°	43°	+40°						
Sep	10	0°	+1°			102°	+39°	48°	+40°						
Sep	15	5°	+2°	**STA**				53°	+40°	**SLY**					
Sep	20			18°	+5°	**DSX**		59°	+41°	120°	+48°				
Sep	25			21°	+6°	152°	−2°			127°	+47°				
Sep	30			25°	+7°	156°	−2°	**ORI**		133°	+46°	**OCT**			
Oct	5			28°	+8°	160°	−2°	85°	+14°	140°	+45°	164°	+79°	**DRA**	
Oct	10			32°	+9°	**EGE**		88°	+15°	147°	+44°			262°	+54°
Oct	15	**NTA**		36°	+11°	99°	+27°	91°	+15°			**LMI**			
Oct	20	38°	+18°	40°	+12°	104°	+27°	94°	+16°			158°	+39°		
Oct	25	43°	+19°	43°	+13°	109°	+27°	98°	+16°			163°	+37°		
Oct	30	47°	+20°	47°	+14°			101°	+16°			168°	+35°		
Nov	5	52°	+21°	52°	+15°			105°	+17°	**LEO**					
Nov	10	56°	+22°	56°	+15°	**NOO**				147°	+24°			**AMO**	
Nov	15	61°	+23°	60°	+16°	81°	+16°			150°	+23°			112°	+2°
Nov	20	65°	+24°	64°	+16°	84°	+16°			153°	+21°			116°	+1°
Nov	25	70°	+24°			88°	+16°	**PHO**		156°	+20°	**PUP**		120°	0°
Nov	30	74°	+24°	**GEM**		92°	+16°	7°	−27°	159°	+19°	119°	−45°	91°	+8°
Dec	5	85°	+23°	103°	+33°	148°	+35°	10°	−27°	122°	+3°	122°	−45°	98°	+9°
Dec	10	90°	+23°	108°	+33°	152°	+34°	13°	−28°	126°	+2°	125°	−45°	101°	+8°
Dec	15	96°	+23°	113°	+33°	157°	+32°			130°	+1°	128°	−45°	105°	+7°
Dec	20	101°	+23°	118°	+32°	161°	+30°			134°	0°	217°	+76°	108°	+7°
Dec	25	106°	+22°			166°	+28°			**HYD**		217°	+74°	**MON**	
Dec	30	111°	+21°	226°	+50°	170°	+26°					**URS**			
		ANT		**QUA**		**COM**								

Table 6a. Dates and radiant positions (in α and δ) for the sources of possible or additional activity described in the text.

Shower	Activity Date	$\lambda_\odot$ 2000.0	Radiant α	Radiant δ	Details see page
255P/Levy (1897)	Jan 01	$280\overset{\circ}{.}752$	330°	+60°	3
κ-Cancrids (793 KCA)	Jan 09	$289\overset{\circ}{.}315$	138°	+9°	3
ι-Centaurids (919 ICN)	Jan 21–26		199°	−39°	3
July γ-Draconids (184 GDR)	Jul 28	$125\overset{\circ}{.}132$	280°	+51°	9
Perseids (007 PER)	Aug 12	$139\overset{\circ}{.}859$			11
	Aug 13	$139\overset{\circ}{.}97$			11
χ-Capricornids (420 CCA)	Sep 09	$166\overset{\circ}{.}880$	344°	−3°	9
Sep. ε-Perseids (208 SPE)	Sep 10	$167\overset{\circ}{.}200$	48°	+40°	12
Leonids (013 LEO)	Nov 17	$234\overset{\circ}{.}716$			18
	Nov 17	$234\overset{\circ}{.}95$			18
	Nov 18	$236\overset{\circ}{.}202$			18
	Nov 19	$236\overset{\circ}{.}438$			18
	Nov 19	$236\overset{\circ}{.}452$			18
	Nov 19	$236\overset{\circ}{.}981$–.992			18

Table 7. Working List of Daytime Radio Meteor Showers. According to the naming rules, all shower names have the prefix 'Daytime' which is omitted in our Table. We only included showers which are listed as "established" in the IAU MDC database and are strong enough for forward scatter observations ($W_{\text{Cmax}} > 500$ in Brown et al., 2010). For recent activity data compiled here see Ogawa (2022; 2023). See also the Table of northern summer daytime showers on page 6. In most cases, the start and end of the activity period are uncertain and the given values are tentative. For the 144 APS we refer to the values provided by Ogawa (2022) and described on page 6.

Shower	Activity	Max Date	$\lambda_\odot$ 2000.0	Radiant α	Radiant δ
April Piscids (`144 APS`)	Apr 20 – Apr 25	Apr 22	$32\overset{\circ}{.}6$	5°	+5°
N. ω-Cetids (`152 NOC`)	May 01 – May 17	May 06	$45\overset{\circ}{.}5$	9°	+17°
S. ω-Cetids (`153 OCE`)	May 01 – May 17	May 06	$45\overset{\circ}{.}5$	20°	−6°
S. May Arietids (`156 SMA`)	May 01 – May 17	May 07	$47\overset{\circ}{.}1$	28°	+8°
Arietids (`171 ARI`)	May 25 – Jun 20	Jun 07	$77\overset{\circ}{.}0$	43°	+24°
ζ-Perseids (`172 ZPE`)	May 30 – Jun 20	Jun 09	$78\overset{\circ}{.}6$	67°	+23°
β-Taurids (`173 BTA`)	Jun 15 – Jul 05	Jun 25	94°	82°	+20°
κ-Leonids (`212 KLE`)	Sep 20 – Sep 30	Sep 25	183°	162°	+15°
Sextantids (`221 DSX`)	Sep 20 – Oct 06	Oct 01	188°	156°	−2°

10 Useful addresses

On the IMO's website http://www.imo.net you find online forms to submit visual reports and reports of fireball sightings. It is also possible to submit reports of visual observation sessions for other observers. You can also access all reports in the database, both of visual data and fireball reports.
Visual reports: http://www.imo.net → Observations → Add a visual observation session
Fireball reports: http://www.imo.net → Observations → Report a fireball

For more information on observing techniques, to see the latest results from well-observed major meteor showers and unusual shower outbursts, or when you wish to submit your results, please use the IMO's website, www.imo.net as your first stop. The web page also allows access to the data for your own analyses. Questions can be mailed to the appropriate address (note the word "meteor" **must** feature in your message's "subject" line to pass the anti-spam filters):

For especially bright meteors: fireball@imo.net
For meteor still imaging: photo@imo.net
For forward-scatter radio observing: radio@imo.net
For meteor moving-imaging: video@imo.net
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Radio Commission: Christian Steyaert, Kruisven 66, 2400 Mol, Belgium; e-mail: observations@rmob.org

Video Commission Sirko Molau, Abenstalstraße 13b, 84072 Seysdorf, Germany; e-mail: sirko@molau.de

Visual Commission: Jürgen Rendtel, Eschenweg 16, 14476 Potsdam, Germany; e-mail: jrendtel@web.de

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