

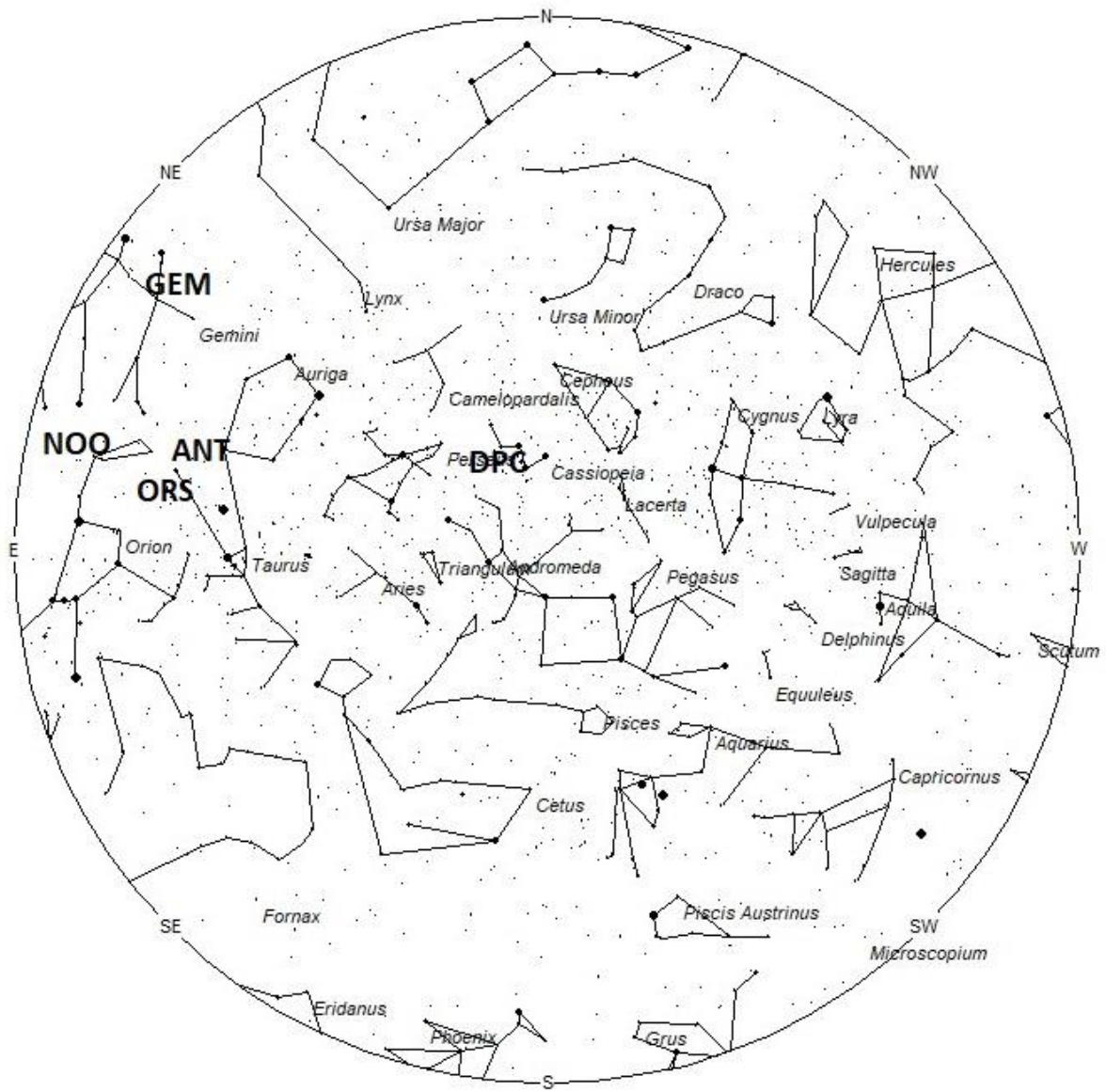
Meteor Activity Outlook for December 7-13, 2024



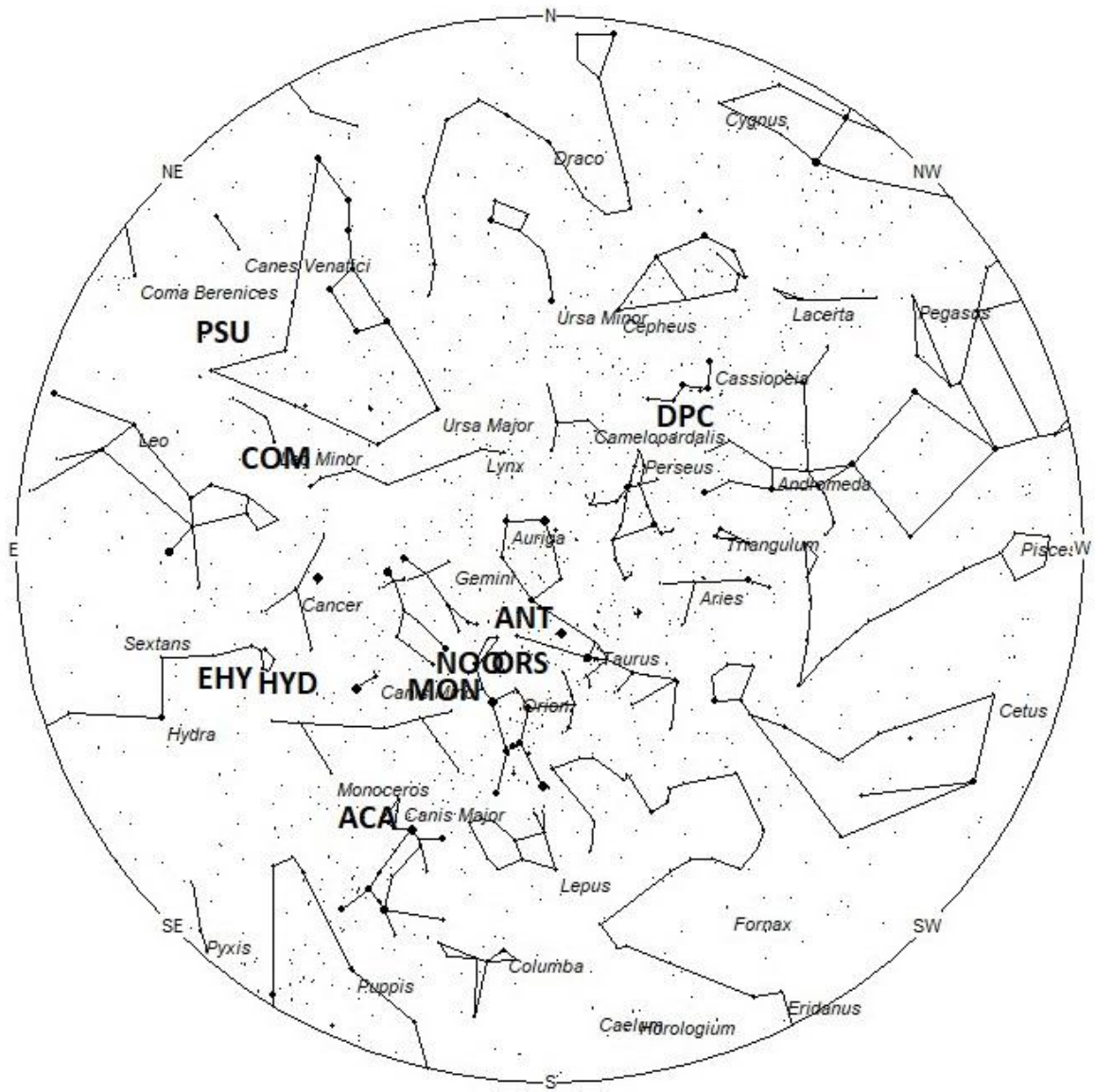
Charles Felder captured this brilliant fireball using his on July 30, 2024, at 00:02 CDT (5:02 UT) from Avery, Texas, USA. ©Charles Felder

During this period, the moon reaches its first quarter phase on Sunday December 8th. At that time the half-illuminated moon will set near midnight, leaving the remainder of the night free of interfering moonlight. As the week progresses, the waxing gibbous moon will enter the morning sky and the window of opportunity to view under dark skies will shrink by approximately 45 minutes with each passing night. The estimated total hourly rates for evening observers this weekend should be near 3 as seen from mid-northern latitudes (45N) and 2 as seen from tropical southern locations (25S). For morning observers, the estimated total hourly rates should be near 27 as seen from mid-northern latitudes (45N) and 21 as seen from tropical southern locations (25S). The actual rates seen will also depend on factors such as personal light and motion perception, local weather conditions, alertness, and experience in watching meteor activity. Evening rates are reduced due to moonlight. Note that the hourly rates listed below are estimates as viewed from dark sky sites away from urban light sources. Observers viewing from urban areas will see less activity as only the brighter meteors will be visible from such locations.

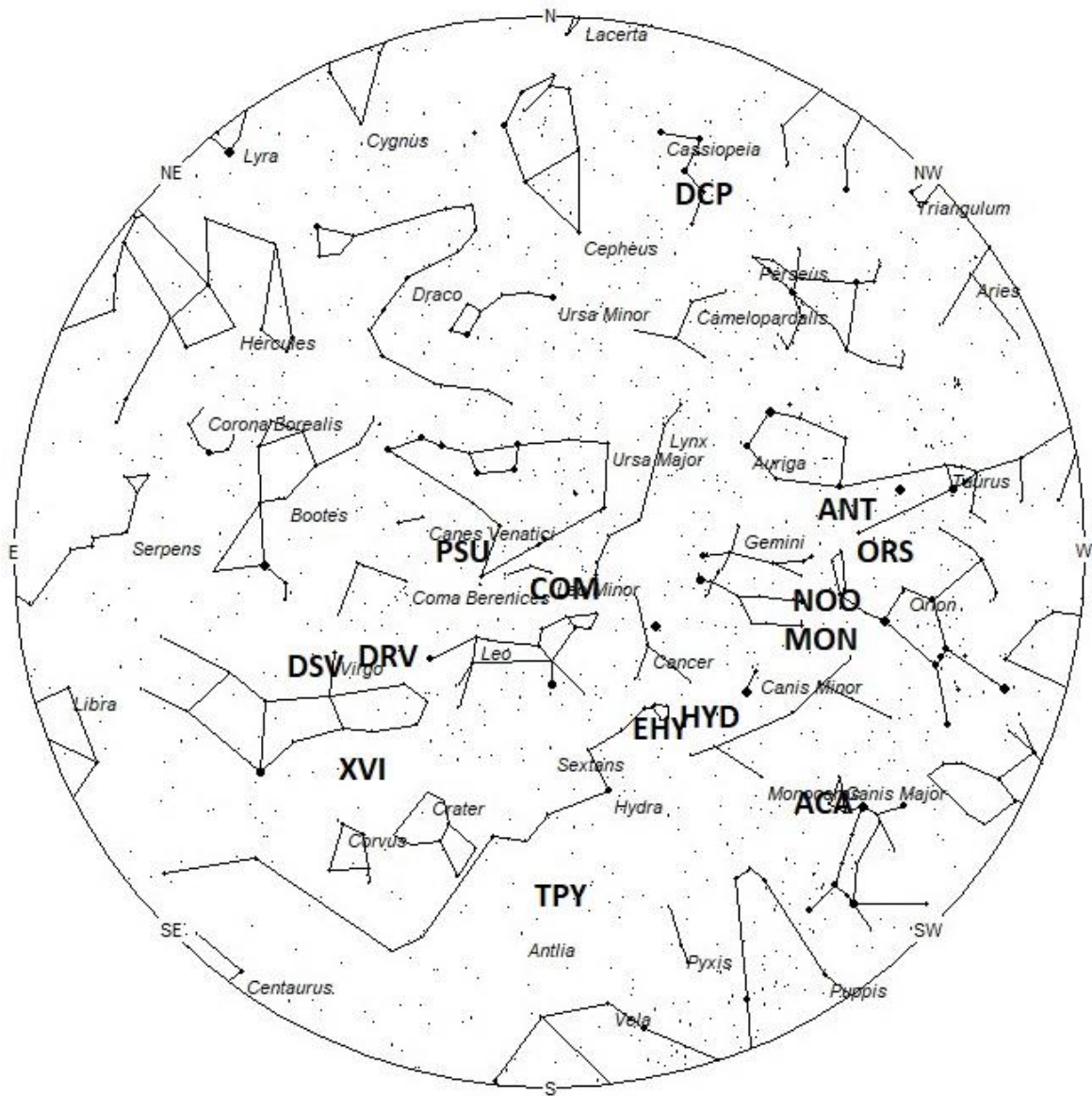
The radiant (the area of the sky where meteors appear to shoot from) positions and rates listed below are exact for Saturday night/Sunday morning December 7/8. These positions do not change greatly day to day so the listed coordinates may be used during this entire period. Most star atlases (available online and at bookstores and planetariums) will provide maps with grid lines of the celestial coordinates so that you may find out exactly where these positions are located in the sky. I have also included charts of the sky that display the radiant positions for evening, midnight, and morning. The center of each chart is the sky directly overhead at the appropriate hour. These charts are oriented for facing south but can be used for any direction by rotating the charts to the desired direction. A planisphere or computer planetarium program is also useful in showing the sky at any time of night on any date of the year. Activity from each radiant is best seen when it is positioned highest in the sky, either due north or south along the meridian, depending on your latitude. Radiants that rise after midnight will not reach their highest point in the sky until daylight. For these radiants, it is best to view them during the last few hours before dawn. It must be remembered that meteor activity is rarely seen at its radiant position. Rather they shoot outwards from the radiant, so it is best to center your field of view so that the radiant lies toward the edge and not the center. Viewing there will allow you to easily trace the path of each meteor back to the radiant (if it is a shower member) or in another direction if it is sporadic. Meteor activity is not seen from radiants that are located far below the horizon. The positions below are listed in a west to east manner in order of right ascension (celestial longitude). The positions listed first are located further west therefore are accessible earlier in the night while those listed further down the list rise later in the night.



Radiant Positions at 19:00 Local Standard Time



Radiant Positions at Midnight Local Standard Time



Radiant Positions at 05:00 Local Standard Time

These sources of meteoric activity are expected to be active this week

The **December phi Cassiopeiids (DPC)** are the classical return of the Andromedids and the radiant that was active prior to the breakup of comet 3D/Biela in the 1840's. This source is active from November 28 through December 10th. Maximum activity is expected to occur on December 4th when the radiant is located at 01:18 (024) +59. This area of the sky is located eastern Cassiopeia, 1 degree southeast of the magnitude star known as Ruchbah (delta Cassiopeiae). These meteors are best seen near 2000 (8pm) LST by looking toward the northern sky. Meteors from the December phi Cassiopeiids strike the atmosphere at 17km/sec., which would produce meteors of very slow velocity. No unusual activity is expected from this source in 2024, but this shower should be monitored during its entire activity for possible outbursts.

The **Southern chi Orionids (ORS)** are active from November 14 through December 16, with maximum activity occurring on November 28th. The radiant is currently located at 05:37 (084) +18, which lies in southeastern Taurus, 3 degrees south of the 3rd magnitude star known as Tianguan (zeta Tauri A). This radiant is best placed in the southern sky near 01:00 LST, when it lies on the meridian and is located highest in the southern sky. Rates at this time should be near 1 per hour as seen from the northern hemisphere and less than 1 as seen south of the equator. With an entry velocity of 26 km/sec., the average ORS meteor would be of medium-slow velocity. Don't confuse these meteors with the similar, but more numerous Anthelion meteors, which lie only 5 degrees to the north.

Now that the activity from particles produced by comet 2P/Encke have ceased encountering the Earth, the Taurid showers for 2024 are over and we resume reporting activity from the **Anthelion (ANT)** radiant. This is not a true radiant, but rather activity caused by the Earth's motion through space. As the Earth revolves around the sun it encounters particles orbiting in a pro-grade motion that are approaching their perihelion point. They all appear to be radiating from an area near the opposition point of the sun, hence the name Anthelion. These were once recorded as separate showers throughout the year, but it is now suggested to bin them into a category separate from true showers and sporadics. This radiant is a very large oval some thirty degrees wide by fifteen degrees high. Activity from this radiant can appear from more than one constellation. The position listed here is for the center of the radiant which is currently located at 05:52 (088) +23. This position lies in eastern Taurus, 3 degrees north of the 4th magnitude star known as chi¹ Orionis. This radiant is best placed near 01:00 local standard time (LST) when it lies on the meridian and is highest in the southern sky. Rates at this time should be near 3 per hour as seen from the northern hemisphere and 2 per hour as seen from south of the equator. With an entry velocity of 30 km/sec., the average Anthelion meteor would be of medium-slow velocity.

The **November Orionids (NOO)** are active from November 13 through December 12, with maximum activity occurring on November 28th. The radiant is currently located at 06:30 (098) +15. This area of the sky lies in southwestern Gemini, 3 degrees southwest of the 2nd magnitude star known as Alhena (gamma Geminorum). This radiant is best placed in the southern sky near 0200 LST, when it lies highest above the horizon. Hourly rates should be near 2 per hour as seen from the northern hemisphere and 1 per hour as seen from south of the equator. With an entry velocity of 41 km/sec., most activity from this radiant would be of medium speed.

The **Monocerotids (MON)** are active from a radiant located at 06:37 (099) +09. This area of the sky is located in northern Monoceros, 4 degrees southwest of the 3rd magnitude star known as Alzirr (xi Geminorum). This position is less than 10 degrees away from the NOO radiant so care must be taken to differentiate between these two showers. This radiant best placed near 0200 LST, when it lies highest in the southern sky. Hourly rates should be near 2 per hour no matter your location. With an entry velocity of 42 km/sec., most activity from this radiant would be of medium speed. This shower is active from November 23rd through December 24th, with maximum activity occurring on December 10th.

The **Geminids (GEM)** are active from December 1-21, peaking on December 13th. The Geminid radiant is currently located at 07:11 (108) +33. This area of the sky lies in northern Gemini, 3 degrees north of the 4th magnitude star known as tau Geminorum. These meteors are best seen near 02:00 LST, when the radiant lies highest in the northern sky. Rates are this weekend are expected to be near 5 per as seen from the northern hemisphere and near 2 as seen from areas south of the equator. With an entry velocity of 33km/sec, most of these meteors would appear to possess a medium velocity.

The **alpha Canis Majorids (ACA)** were also discovered by Dr. Peter Brown during his 7-year survey using the Canadian Meteor Orbit Radar (CMOR2). This source is active from November 2 through December 11 with maximum occurring near November 21st. The radiant is currently located at 07:11 (109) -15 which places it in northern Canis Major, 1 degree northeast of the 4th magnitude star known as Muliphein (gamma Canis Majoris). These meteors are best seen near 0200 LST when it lies on the meridian and is located highest in the southern sky. Current rates should be less than 1 per hour no matter your location. With an entry velocity of 44 km/sec., the average ACA meteor would be of medium velocity.

The **sigma Hydrids (HYD)** are active from a radiant located at 08:22 (126) +03. This area of the sky is located in northwestern Hydra, 3 degrees west of the 4th magnitude star known as sigma Hydrae. These meteors are active from November 22nd through December 31st, with maximum activity occurring on December 7th. These meteors are best placed above the southern horizon near 03:00 LST. Rates should be near 2 per hour no matter your location. With an entry velocity of 59km/sec, most of these meteors would appear swift.

The **eta Hydrids (EHY)** were recently discovered by members of the Croatian Meteor Network. This radiant is active from November 26 through January 1st with maximum activity occurring on December 12th. The radiant is currently located at 08:50 (133) +02, which places it in northwestern Hydra, 2 degrees southwest of the 4th magnitude star known as eta Hydrae. This position is close to that of the sigma Hydrids so care must be taken to separate the two sources. These meteors are best seen near 0400 LST when the radiant lies highest above the southern horizon. Current rates should be less than 1 per hour no matter your location. With an entry velocity of 62 km/sec., most activity from this radiant would be of swift speed.

The **Puppis-Velid Complex (PUV)** are a vast complex of weak radiants located in the constellations of Puppis and Vela. Visual plots and photographic studies have revealed many radiants in this area during November and December. The combined strength of these radiants can produce a ZHR of 10. Actual hourly rates will be much less unless you happen to be observing

from the deep southern hemisphere. Activity from this source begins around November 22nd. The center of this activity is currently located at 08:59 (135) -49. This position lies in central Vela, 5 degrees southwest of the 2nd magnitude star known as Suhail (λ Velorum). Peak rates occur near December 8th. These meteors are best seen near 0400 LST when the radiant lies highest in the southern sky. Observers located in the southern hemisphere have an advantage viewing this shower as the radiant will rise higher into their sky allowing more activity to be seen. Since the radiant lies low in the south for most northern hemisphere observers, meteors seen from north of the equator tend to be long in length and long-lasting. At 42 km/sec. the Puppis-Velids produce meteors of average velocity. Note: these are also listed as the “e Velids” from several sources.

The **theta Pyxidids (TPY)** consist of two weak showers that peak two weeks apart. The late version is active from December 8 through January 8 with maximum occurring on December 18th. The radiant is currently located at 09:42 (145) -23. This area of the sky is located in southwestern Hydra, 5 degrees north of the faint star known as theta Antliae. These meteors are best seen during the last couple of hours prior to dawn when the radiant lies highest in the southern sky. At 61 km/sec. the theta Pyxidids would produce mostly swift meteors.

The **Comae Berenicids (COM)** are a long duration shower active from December 5th through February 4th. Maximum activity occurs on December 16th. The radiant is currently located at 10:02 (152) +35, which places it in central Leo Minor, 1 degree southwest of the 4th magnitude star known as 21 Leonis Minoris. These meteors would be best seen near 05:00 LST, when the radiant lies highest in the eastern sky. Current rates would be near 1 per hour as seen from the northern hemisphere and less than one as seen from south of the equator. At 63km/sec., these meteors would produce mostly swift meteors.

The **psi Ursa Majorids (PSU)** were discovered by observers in Japan using data from SonotaCo. This shower is active from November 29-December 11 with maximum activity occurring on December 4th. The radiant is currently located at 11:35 (174) +41. This position lies in southern Ursa Major, 2 degrees northeast of the faint star known as 57 Ursae Majoris. This area of the sky is best placed during the last hour before dawn, when it lies highest above the northern horizon in a dark sky. Current hourly rates would most likely be less than one per hour no matter your location. At 61km/sec., the average psi Ursa Majorid meteor would be swift.

The **December chi Virginids (XVI)** were discovered in Japan by observers using data from SonotaCo. This source is active from November 26 through December 30 with maximum occurring on December 14th. The radiant is currently located at 12:29 (187) -08, which places it in southwestern Virgo, 2 degrees west of the faint star known as chi Virginis. Hourly rates should be less than 1 no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the eastern horizon in a dark sky. At 68 km/sec. the December chi Virginids would produce mostly swift meteors.

The **December rho Virginids (DRV)** are active from November 17 through December 26 with peak rates occurring near December 7th. The current radiant location is at 12:33 (188) +13, which places it on the Virgo/Coma Berenices border, 3 degrees northwest of the faint star known as rho Virginis. Current hourly rates would be less than 1 no matter your location. These meteors are best

seen during the last dark hour before dawn, when the radiant lies highest above the eastern horizon in a dark sky. At 68 km/sec. the December rho Virginids would produce mostly swift meteors.

The **December sigma Virginids (DSV)** is a source of long duration discovered by John Greaves using the data from SonotaCo. This source is active from November 26 through January 24 with peak rates occur near December 23rd. The current radiant location is at 13:04 (196) +08, which places it in northern Virgo, 3 degrees southeast of the 3rd magnitude star known as Vindemiatrix (epsilon Virginis). Current hourly rates would be less than 1 no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the eastern horizon in a dark sky. At 66 km/sec. the December Sigma Virginids would produce mostly swift meteors.

Sporadic meteors are those meteors that cannot be associated with any known meteor shower. All meteor showers are evolving and disperse over time to the point where they are no longer recognizable. Away from the peaks of the major annual showers, these sporadic meteors make up the bulk of the activity seen each night. As seen from the mid-northern hemisphere (45N) one would expect to see during this period approximately 11 sporadic meteors per hour during the last hour before dawn as seen from rural observing sites. Evening rates should be near 2 per hour. As seen from the tropical southern latitudes (25S), morning rates would be near 8 per hour as seen from rural observing sites and 1 per hour during the evening hours. Locations between these two extremes would see activity between these listed figures.

The list below offers the information in tabular form of the showers that I feel are within reach of the visual observer to discern. Hourly rates are often less than one, so these sources are rarely listed as visual targets in most meteor shower lists. If you are like me and wish to associate as many meteors as possible with known sources, then you will appreciate these listings. Before listing meteors from these obscure sources, you should attempt to prove these meteors belong to them and are not chance alignments of sporadic meteors. You can note parameters such as duration, length, radiant distance and the elevation of each meteor to help compute the probability of shower association. It should be remembered that slow meteors can be seen from fast showers, but fast meteors cannot be produced from slow showers. Slower showers are those with velocities less than 35/km per second. Slow meteors can appear from fast showers when they appear close to the radiant or low in the sky. The table located on page 22 of the [IMO's 2024 Meteor Shower Calendar](#) is a big help in aiding in the identification of meteors. If you record the length and duration of each meteor, you can use this chart to check the probability of the meteor belonging to a shower of known velocity. If the angular velocity is similar to the figure in the table, then your meteor probably belongs to that shower. Rates and positions are exact for Saturday night/Sunday morning.

SHOWER	DATE OF MAXIMUM ACTIVITY	CELESTIAL POSITION	ENTRY VELOCITY	CULMINATION	HOURLY RATE	CLASS
		RA (RA in Deg.) DEC	Km/Sec	Local Standard Time	North- South	
December phi Cassiopeiids (DPC)	Dec 04	01:18 (024) +59	17	20:00	<1 - <1	IV
Southern chi Orionids (ORS)	Nov 28	05:37 (084) +18	26	01:00	1 - <1	IV
Anthelion (ANT)	Nov 08	05:52 (088) +23	30	01:00	3 - 2	II
November Orionids (NOO)	Nov 28	06:30 (098) +15	41	02:00	2 - 1	II
Monocerotid s (MON)	Dec 10	06:37 (099) +09	42	02:00	2 - 2	II
Geminids (GEM)	Dec 13	07:11 (108) +33	33	02:00	5 - 2	II
alpha Canis Majorids (ACA)	Nov 21	07:11 (109) -15	44	02:00	<1 - <1	II
sigma Hydrids (HYD)	Dec 07	08:22 (126) +03	59	03:00	2 - 2	II
eta Hydrids (EHY)	Dec 12	08:50 (133) +02	62	03:00	<1 - <1	IV
Puppilid-Velid Complex (PUV)	Dec 08	08:59 (135) -49	42	03:00	1 - 5	II
theta Pyxidids (TPY)	Dec 01	09:42 (145) -23	61	04:00	<1 - <1	IV
Comae Berenicids (COM)	Dec 19	10:02 (152) +35	63	05:00	1 - <1	II
psi Ursa Majorids (PSU)	Dec 04	11:35 (174) +41	61	06:00	<1 - <1	IV

December chi Virginids (XVI)	Dec 14	12:29 (187) -08	68	07:00	<1 - <1	IV
December rho Virginids (DRV)	Dec 07	12:33 (188) +13	68	07:00	<1 - <1	IV
December sigma Virginids (DSV)	Dec 23	13:04 (196) +08	66	08:00	<1 - <1	IV

You can keep track of the activity of these meteor showers as well as those beyond the limits of visual observing by visiting the [NASA Meteor Shower Portal](#). You can move the sky globe to see different areas of the sky. Colored dots indicate shower meteors while white dots indicate sporadic (random) activity. The large orange disk indicates the position of the sun so little activity will be seen in that area of the sky.

Class Explanation: A scale to group meteor showers by their intensity:

- **Class I:** the strongest annual showers with Zenith Hourly Rates normally ten or better.
- **Class II:** reliable minor showers with ZHR's normally two to ten.
- **Class III:** showers that do not provide annual activity. These showers are rarely active yet have the potential to produce a major display on occasion.
- **Class IV:** weak minor showers with ZHR's rarely exceeding two. The study of these showers is best left to experienced observers who use plotting and angular velocity estimates to determine shower association. These weak showers are also good targets for video and photographic work. Observers with less experience are urged to limit their shower associations to showers with a rating of I to III.