

Meteor Activity Outlook for December 16-22, 2023

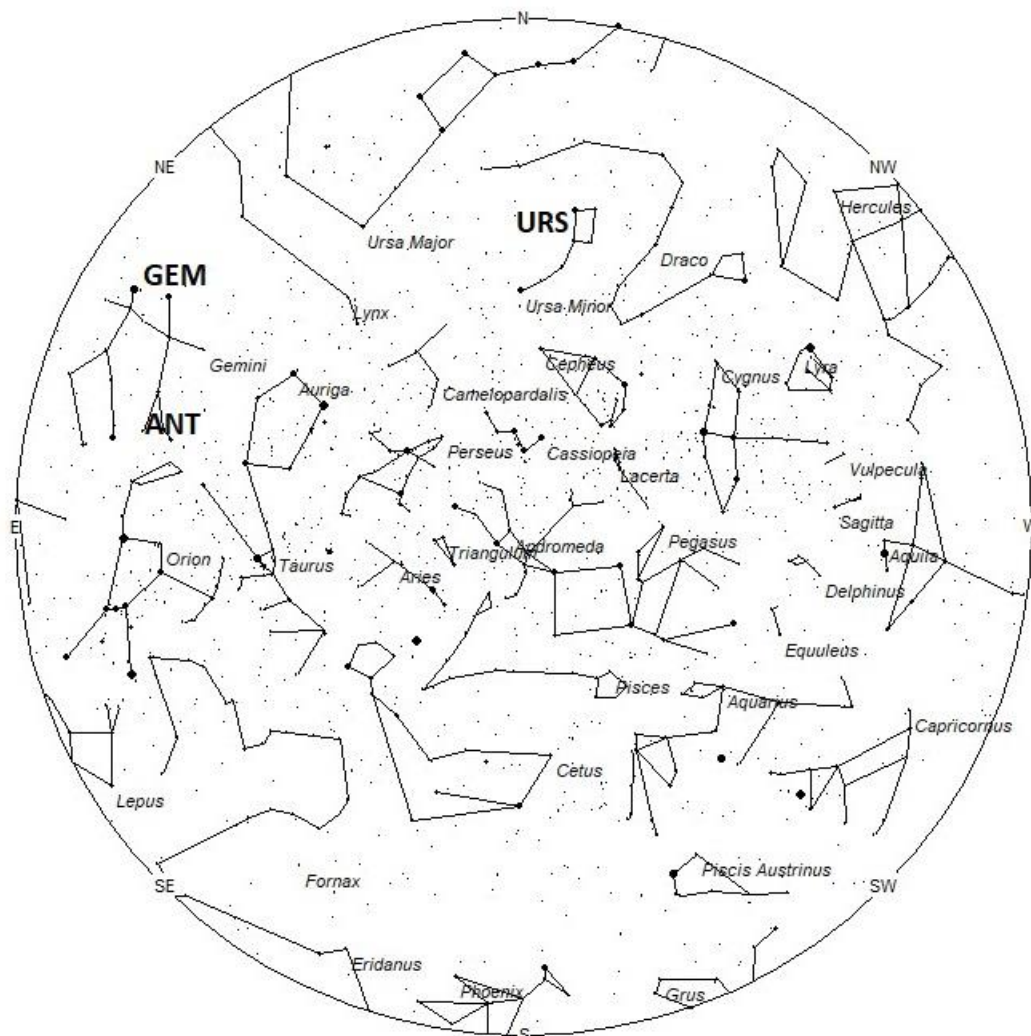


Pavel Vorobiev captured this colorful fireball on July 23, 2023, at 01:46 PDT (4:37 UT on July 21) from Laguna Hanson, Baja California Norte, Mexico. ©Pavel Vorobiev (CIMAV Monterrey)

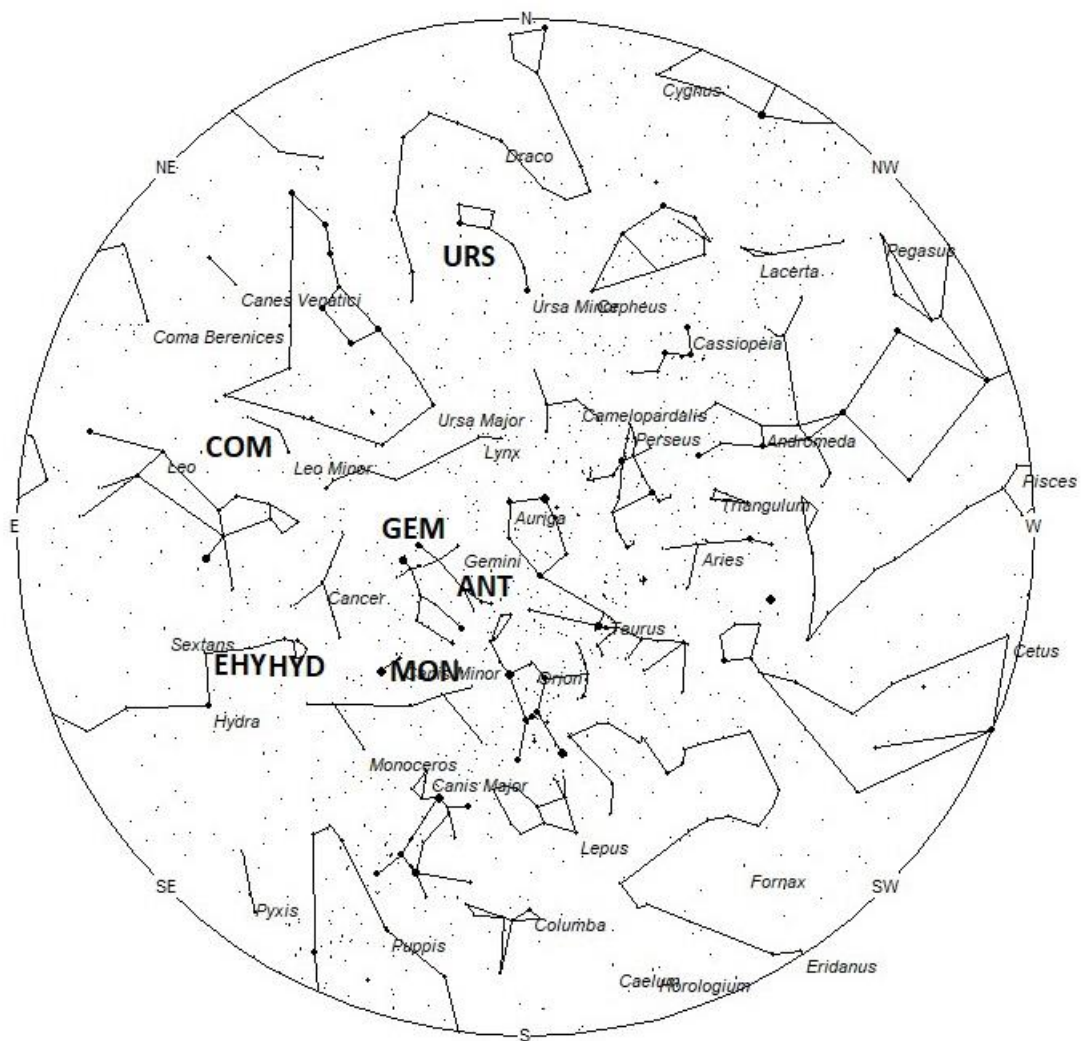
During this period, the moon reaches its first quarter phase on Tuesday December 19th. On that night the half-illuminated moon will lie 90 degrees east of the sun and will set near midnight (on Dec 19/20). This weekend the waxing crescent moon will set during the late evening hours, leaving the more active morning hours free of interfering moonlight. 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 25 as seen from mid-northern latitudes (45N) and 18 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 16/17. These positions do not change greatly day to day so the listed coordinates may be used during this entire period. Most star atlases (available at science stores 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

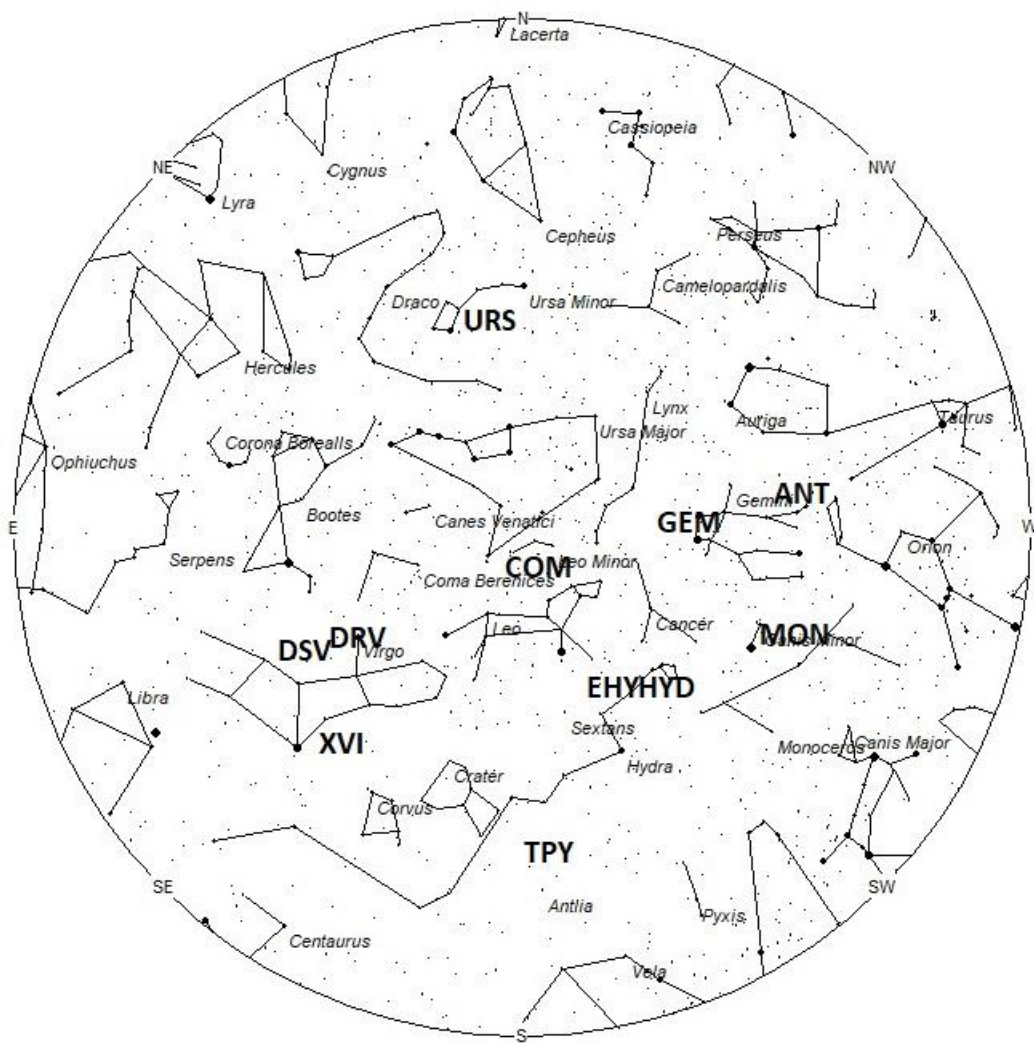
in showing the sky at any time of night on any date of the year. Activity from each radiant is best seen when it is positioned highest in the sky, either due north or south along the meridian, depending on your latitude. Radiants that rise after midnight will not reach their highest point in the sky 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 7pm Local Standard Time



Radiant Positions at Midnight Local Standard Time



Radiant Positions at 5am Local Standard Time

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

Now that the activity from particles produced by comet 2P/Encke have ceased encountering the Earth, the Taurid showers for 2023 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 06:32 (098) +23. This position lies in western Gemini, 2 degrees northeast of the 3rd magnitude star known as Tejat (mu Geminorum). 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 slow velocity.

The **Monocerotids (MON)** are active from a radiant located at 07:00 (105) +07. This area of the sky is located in northwestern Monoceros, 5 degrees northeast of the 4th magnitude star known as 18 Monocerotis. This radiant best placed near 0100 LST, when it lies highest in the southern sky. Rates should be near 1 per hour no matter your location. With an entry velocity of 40 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 11th.

The **Geminids (GEM)** are still active from a radiant located at 07:46 (117) +32. This area of the sky lies in northeastern Gemini, 2 degrees east of the 2nd magnitude star known as Castor (alpha Geminorum). These meteors are best seen near 02:00 LST, when the radiant lies highest in the southern sky. Rates are expected to be near 5 per hour as seen from the northern hemisphere and near 2 as seen from the tropical southern hemisphere. With an entry velocity of 34km/sec, most of these meteors would appear to possess a medium velocity.

The **sigma Hydrids (HYD)** are active from a radiant located at 08:50 (133) +01. This area of the sky is located in western Hydra, 3 degrees southeast of the 4th magnitude star known as eta hydrae. These meteors are active from November 24 through January 7th, with the main maximum activity occurring on December 7th. To best see these meteors, face toward the south during the last couple of hours prior to dawn. With an entry velocity of 58km/sec, most of these meteors would appear swift. Expect to see 1 per hour no matter your location.

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 09:18 (140) +01, which places it in western Hydra, 1 degree northeast of the 4th magnitude star known as theta 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 **theta Pyxidids (TPY)** consists of two weak showers that peak two weeks apart. The later version is active from December 8 through January 8, with maximum occurring on December 18th. The radiant is currently located at 10:11 (153) -24. This area of the sky is located in southwestern Hydra, 7 degrees south of the 4th magnitude star known as mu Hydrae. These meteors are best seen near 0500 LST when the radiant lies highest in the southern sky. Rates are expected to be less than 1 no matter your location. At 62 km/sec. the theta Pyxids 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 10:34 (159) +32, which places it in central Leo Minor, 4 degrees southeast of the 4th magnitude star known as beta Leonis Minoris. These meteors would be best seen near 05:00 LST, when the radiant lies highest in the eastern sky. Current rates should be near 2 per hour as seen from the northern hemisphere and near one as seen from south of the equator. At 63km/sec., these meteors would produce mostly swift meteors.

The **December chi Virginids (XVI)** was discovered by Japanese observers using data from SonotaCo. This source is active from November 26 through December 30 with maximum occurring on December 12th. The radiant is currently located at 12:51 (193) -11, which places it in southern Virgo, 7 degrees west of the 1st magnitude star known as Spica (alpha Virginis). Hourly rates should be near 1 no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the southeastern 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 29 through December 22 with peak rates occurring near December 5th. The current radiant location is at 13:04 (196) +12, which places it in northern Virgo, near the spot occupied by 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 southeastern 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 occurring near December 21st. The current radiant location is at 13:32 (203) +06, which places it in northern Virgo, 7 degrees north of the 3rd magnitude star known as Heze (zeta Virginis A). 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 southeastern horizon in a dark sky. At 66 km/sec. the December Sigma Virginids would produce mostly swift meteors.

The **Ursids (URS)** are active from a radiant located at 13:40 (205) +76. This area of the sky is located in western Ursa Minor, 5 degrees northwest of the 2nd magnitude star known as Kochab (beta Ursae Minoris). The Ursids are active from December 13-24, with maximum activity

occurring on the 22nd. Current rates are expected to be less than 1 per hour, increasing to 5-10 at maximum activity on the morning of the 22nd. These meteors are best seen in the last few hours before dawn when the radiant lies highest in the northern sky. At 35km/sec., these meteors are of medium velocity. Due to the high northern location, these meteors are not visible from the southern hemisphere.

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 would be near 2 per hour. As seen from the tropical Southern latitudes (25S), morning rates would be near 9 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. Evening rates are reduced due to moonlight.

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.

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 1 but noting parameters such as the duration, radiant distance and the elevation of each meteor, one can compute the probability of shower association. Most showers discovered by video means have rates less than 1 meteor per **night** away from maximum, so the showers listed in these articles are not as weak as they seem. 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	
Anthelions (ANT)	-	06:34 (099) +15	30	01:00	3 - 2	II
Monocerotids (MON)	Dec 11	07:00 (105) +07	40	01:00	1 - 1	II
Geminids (GEM)	Dec 14	07:46 (117) +32	34	02:00	5- 2	I
sigma Hydrids (HYD)	Dec 07	08:50 (133) +01	58	03:00	1- 1	II

eta Hydrids (EHY)	Dec 12	09:18 (140) +01	62	04:00	<1 - <1	III
theta Pyxidids (TPY)	Dec 18	10:11 (153) -24	62	05:00	<1- <1	IV
Comae Bericids (COM)	Dec 16	10:34 (159) +32	63	05:00	2- 1	II
December chi Virginids (XVI)	Dec 12	12:51 (193) -11	68	07:00	1- 1	IV
December rho Virginids (DRV)	Dec 05	13:04 (196) +12	68	07:00	<1- <1	IV
December sigma Virginids (DSV)	Dec 21	13:09 (197) +07	66	08:00	<1 - <1	IV
Ursids (URS)	Dec 22	13:40 (205) +76	35	07:00	<1 - <1	I

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.