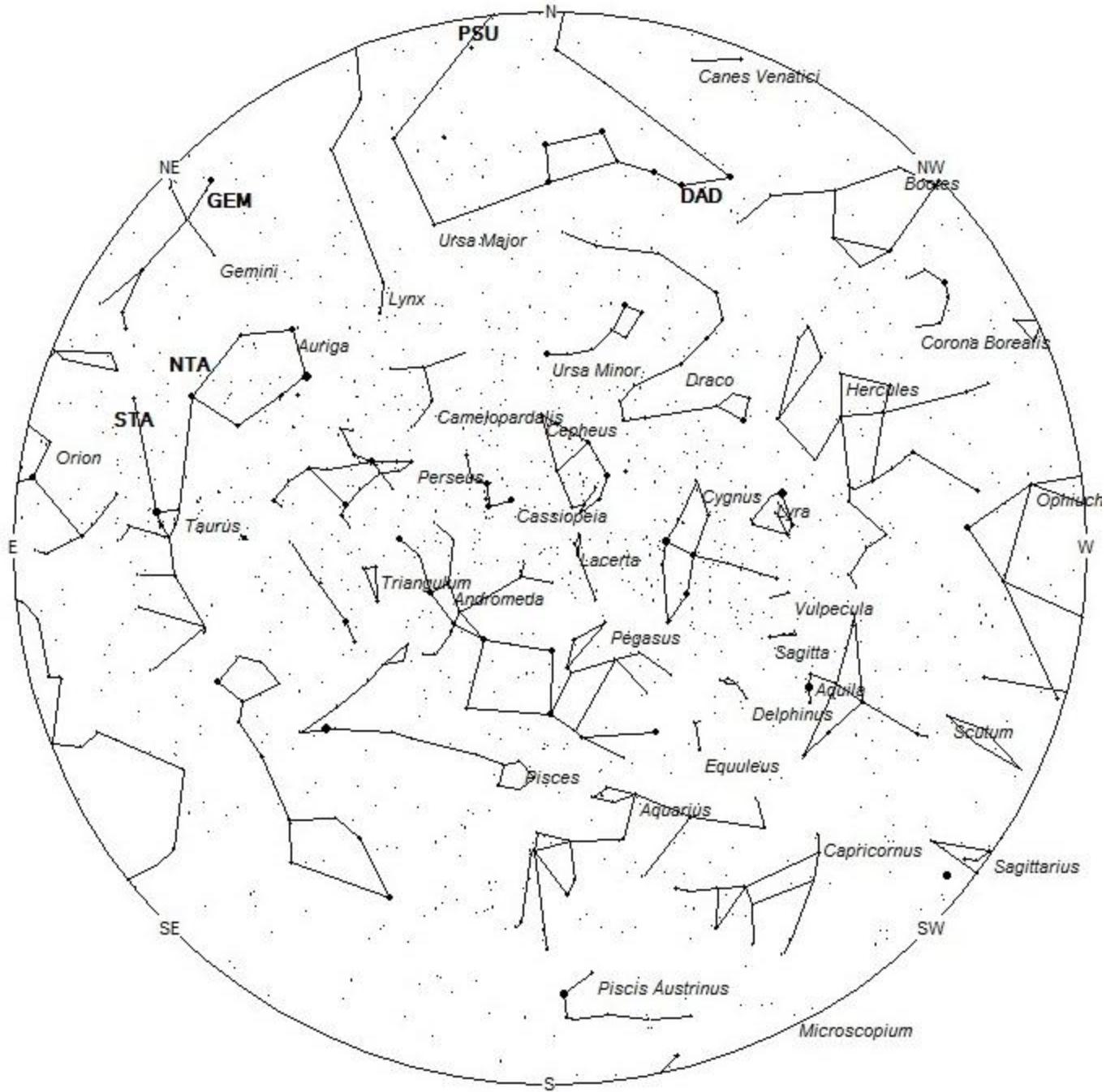


# Meteor Activity Outlook for December 7-13, 2019

During this period the moon reaches its full phase on Thursday December 12th. At this time the moon will be located opposite the sun and will lie above the horizon all night long. This weekend the waxing gibbous moon will set a couple of hours before dawn allowing a quick session under dark skies before the onset of dawn. The estimated total hourly meteor rates for evening observers this week is near 4 for those viewing from the northern hemisphere and 3 for those located south of the equator. For morning observers the estimated total hourly rates should be near 24 as seen from mid-northern latitudes (45N) and 18 as seen from tropical southern locations (25S). The actual rates 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 brightest meteors will be visible from such locations.

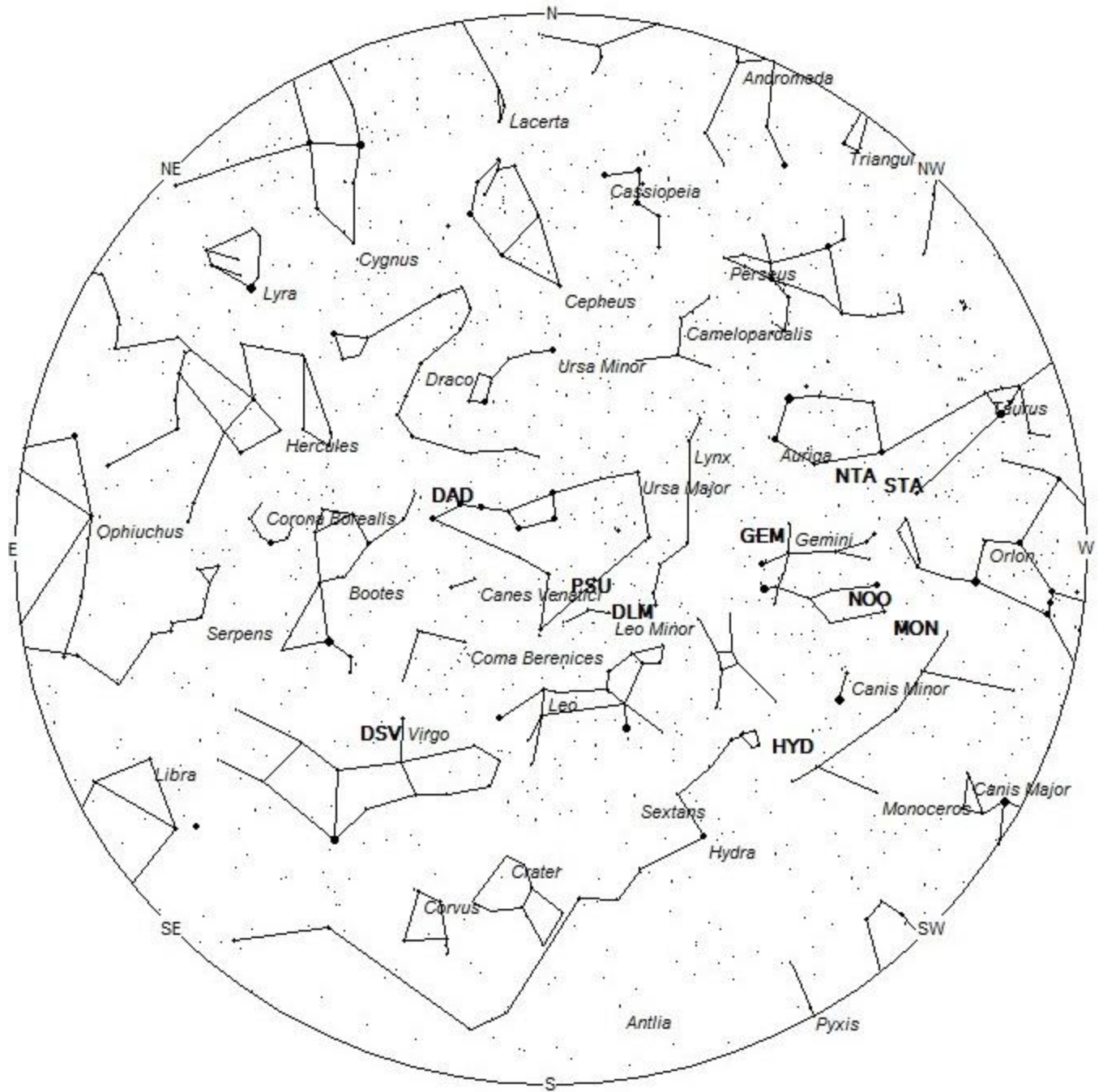
The radiant (the area of the sky where meteors appear to shoot from) positions and rates listed below are exact for Saturday night/Sunday morning December 07/08. These positions do not change greatly day to day so the listed coordinates may be used during this entire period. Most star atlases (available 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. 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. It must be remembered that meteor activity is rarely seen at the radiant position. Rather they shoot outwards from the radiant so it is best to center your field of view so that the radiant lies at 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 a sporadic. Meteor activity is not seen from radiants that are located 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 00:00 Local Standard Time



Radiant Positions at 05:00 Local Standard Time

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

The **Northern Taurids (NTA)** are active from a large radiant located at 05:44 (086) +30. This area of the sky is located in southern Auriga, 3 degrees northeast of the 2<sup>nd</sup> magnitude star known as El Nath (beta Tauri). This position is close to the Southern Taurids so care must be taken in separating these meteors. You should have the two radiants near the center of your field of view to properly differentiate these sources. Current rates should be 1 per hour as seen from mid-northern latitudes and less than 1 per hour as seen from south tropical latitudes (25S). These meteors may be seen all night long but the radiant is best placed near midnight LST when it lies on the meridian and is located highest in the sky. With an entry velocity of 28 km/sec., the average Northern Taurid meteor would be of slow velocity.

The **Southern Taurids (STA)** are active from a large radiant centered near 05:50 (088) +23. This position lies in eastern Taurus, 7 degrees southeast of the 2<sup>nd</sup> magnitude star known as El Nath (beta Tauri). These meteors may be seen all night long but the radiant is best placed near midnight LST when it lies on the meridian and is located highest in the sky. Hourly rates at this time should be less than 1 no matter your location. With an entry velocity of 27 km/sec., the average Southern Taurid meteor would be of slow velocity.

The **Monocerotids (MON)** are active from November 28th through December 27th with the peak activity occurring on December 13th. The radiant is currently located at 06:32 (098) +08. This position lies in northern Monoceros, 8 degrees south of the 2<sup>nd</sup> magnitude star known as Alhena (gamma Geminorum). This position is only 7 degrees south of the radiant of the November Orionids so care must be taken to distinguish between the two. Current rates should be near 1 per hour no matter your location. Rates at maximum may reach 2 per hour. The Monocerotids are best seen near 0100 LST when the radiant lies highest above the horizon. At 41 km/sec. the Monocerotids produce mostly meteors of medium velocity.

The **November Orionids (NOO)** are active from a radiant located at 06:42 (101) +15. This area of the sky lies in southwestern Gemini, 1 degree southeast of the 2<sup>nd</sup> magnitude star known as Alhena (gamma Geminorum). This radiant is best placed in the sky near 0100 LST, when it lies highest above the horizon. This stream is active from November 7 through December 17, with maximum activity occurring on November 29. Rates should be near 2 per hour as seen from the northern hemisphere and 1 as seen from south of the equator. With an entry velocity of 43 km/sec., most activity from this radiant would be of medium speed.

The **Geminids (GEM)** are active from December 1-22, with peak activity occurring on December 14th. This weekend the radiant is located near 07:10 (108) +33. This position lies in northern Gemini, 4 degrees northwest of the 2<sup>nd</sup> magnitude star known as Castor (alpha Geminorum). Rates this weekend should be near 5 per hour as seen from the northern hemisphere and 3 as seen from south of the equator. This radiant is best placed in the sky near 0200 LST, when it lies highest above the horizon. At 34 km/sec. the Geminids produce mostly meteors of medium velocity.

The **Puppis-Velids (PUP)** 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 December 1st. The center of this activity is currently located at 08:14 (124) -45. This position lies in western Vela, 3 degrees northeast of the 2nd magnitude star known as gamma Velorum. Peak rates occur near December 7. These meteors are best seen near 0300 LST when the radiant lies highest above the horizon in a dark 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 40 km/sec. the Puppis-Velids produce meteors of average velocity. Note: these are also listed as the "e Velids" from several sources.

The **sigma Hydrids (HYD)** are active from a radiant located at 08:22 (126) +02. This area of the sky is located in western Hydra, 3 degrees southwest of the faint star known as sigma Hydrae in the head of the serpent. With maximum activity occurring on December 6<sup>th</sup>, current rates should be near 2 per hour no matter your location. These meteors are best seen near 0300 LST, when it lies highest above the horizon in a dark sky. With an entry velocity of 61 km/sec., the average sigma Hydrid meteor would be of swift velocity.

The **December Leonis Minorids (DLM)** are a shower of long duration active from December 6th through January 18th. Maximum occurs near December 21st when rates may reach 3 an hour. During this period I would expect an hourly rates near 1 from a radiant located at 09:54 (148) +35. This position lies in western Leo Minor, 3 degrees southwest of the faint star known as 21 Leo Minoris. These meteors are best seen near 0400 LST when the radiant lies highest above the horizon. At 63 km/sec. the December Leonis Minorids produce mostly swift meteors.

The **Psi Ursa Majorids (PSU)** were discovered by observers in Japan using data from SonotaCo. This shower is active from December 2-10 with maximum activity occurring on December 5th. At maximum the radiant is located at 11:16 (169) +42. This position lies in central Ursa Major, 3 degrees southeast of the third magnitude star known as Psi Ursae Majoris. This area of the sky is best placed during the last hour before dawn, when it lies highest above the horizon in a dark sky. Current rates would most likely be less than one per hour and may reach 1 per hour at maximum. Observers south of the equator would see rates less than 1 per hour due to the lower radiant elevation. At 62km/sec., the average Psi Ursa Majorid meteor would be swift.

The **December Sigma Virginids (DSV)** was discovered by John Greaves using the data of SonotaCo. IMO video cameras confirmed that this source is active during the month of December. Peak rates occur near December 14th. The current radiant location is at 13:02 (195) +08 which places it in northern Virgo, 3 degrees southeast of the 3<sup>rd</sup> magnitude star known as Vindemiatrix (epsilon Virginis). Current hourly rates would be less than 1 shower members no matter your location. These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the horizon in a dark sky. At 68 km/sec. the December Sigma Virginids would produce mostly swift meteors.

The **December Alpha Draconids (DAD)** were discovered by the Japanese observers using data from SonotaCo. This source is active from November 30-December 15, with maximum activity occurring on December 8th. The radiant is currently located at 13:34 (204) +58. This position actually lies in northeastern Ursa Major, 3 degrees northeast of the second magnitude star known as Mizar (zeta Ursae Majoris). These meteors are best seen during the last dark hour before dawn, when the radiant lies highest above the horizon in a dark sky. This shower is not well seen from the southern hemisphere. Current rates would most likely be near 1 per hour as seen from the northern hemisphere. Observers south of the equator would see rates less than 1 per hour due to the lower radiant elevation. At 44 km/sec. meteors from this source would produce mostly medium velocity meteors.

As seen from the mid-northern hemisphere (45N) one would expect to see 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 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 the listed figures. Evening rates are reduced by moonlight during this period.

The list below offers the information from above in tabular form. Rates and positions are exact for Saturday night/Sunday morning except where noted in the shower descriptions.

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	
Northern Taurids (NTA)	Nov 03	05:44 (086) +30	28	00:00	1 - <1	II
Southern Taurids (STA)	Oct 29	05:50 (088) +23	27	00:00	<1 - <1	II
Monocerotids (MON)	Dec 13	06:32 (098) +08	41	01:00	1 - 1	II
November Orionids (NOO)	Nov 29	06:42 (101) +15	43	01:00	2 - 1	II
Geminids (GEM)	Dec 14	07:10 (108) +33	34	02:00	5 - 3	I
Puppilid-Velids (PUP)	Dec 07	08:14 (124) - 45	40	03:00	<1 - 1	II
sigma Hydrids	Dec 06	08:22 (126) +02	61	03:00	2- 2	II

(HYD)						
December Leonis Minorids (DLM)	Dec 21	09:54 (148) +35	63	04:00	1 - <1	II
Psi Ursa Majorids (PSU)	Dec 05	11:16 (169) +42	62	06:00	<1 - <1	IV
December Sigma Virginids (DSV)	Dec 14	13:02 (195) +08	68	08:00	<1 - <1	IV
December Alpha Draconids (DAD)	Dec 08	13:34 (204) +58	44	08:00	1 - <1	IV