

# Meteor Activity Outlook for December 11-17, 2021

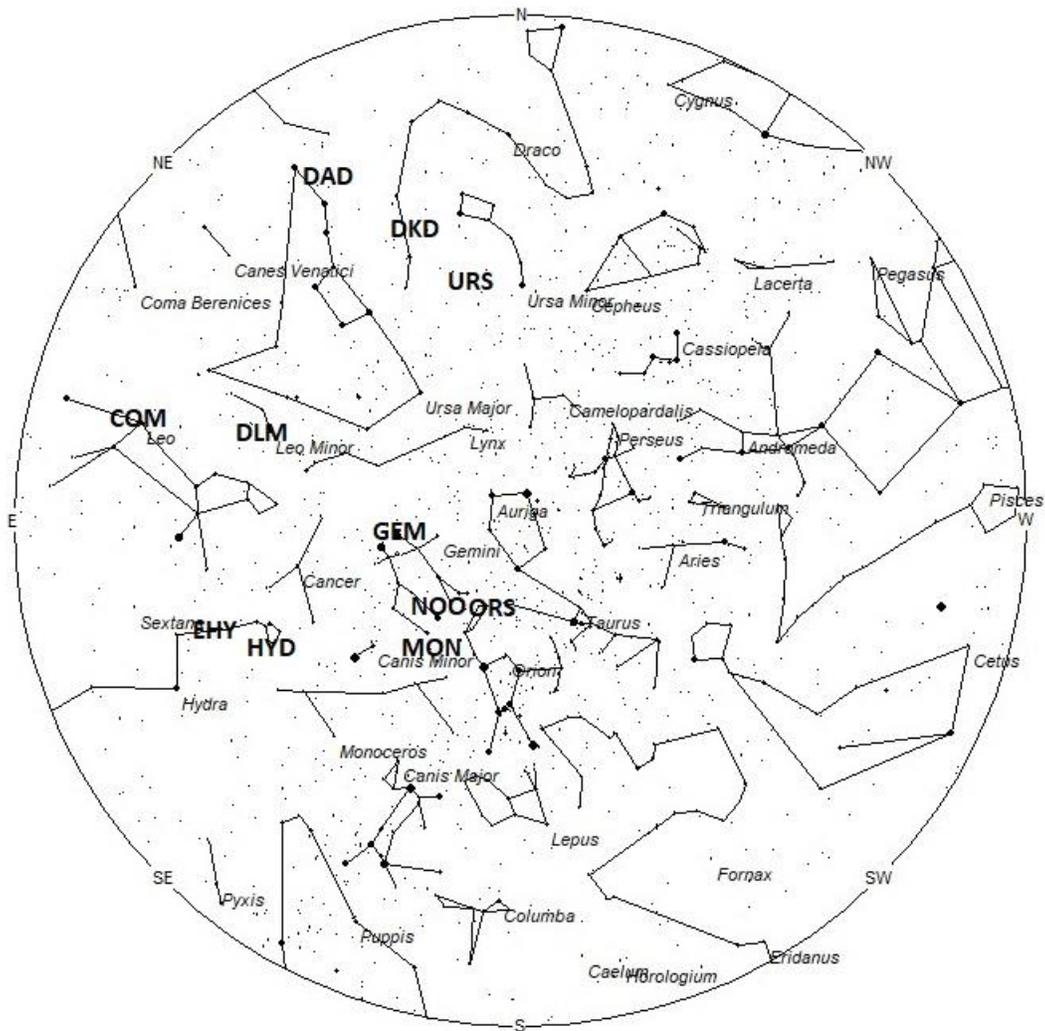


Terry Hancock and Tom Masterson were photographing comet C/2021 A1 Leonard's passage by the globular cluster Messier 3 on the morning of December 3, 2021, from Grand Mesa Observatory, Purdy Mesa, Colorado, USA. During this exposure a bright meteor passed through the field of view leaving a bright streak and ghostly golden strands from the resulting train. Technical information: 4:31 AM MST (11:31 UT), December 3rd, 2021 Single 120 second combined with 40% mix for noise reduction from a 90 x 120 second stack. Camera: QHY367 Pro C Full Frame One Shot Color CMOS Optics: Takahashi E-180 Astrograph Image Acquisition software Maxim DL6 Pre-Processed in Pixinsight Post Processed in Photoshop. ©Terry Hancock and Tom Masterson <https://www.transientastronomer.com>

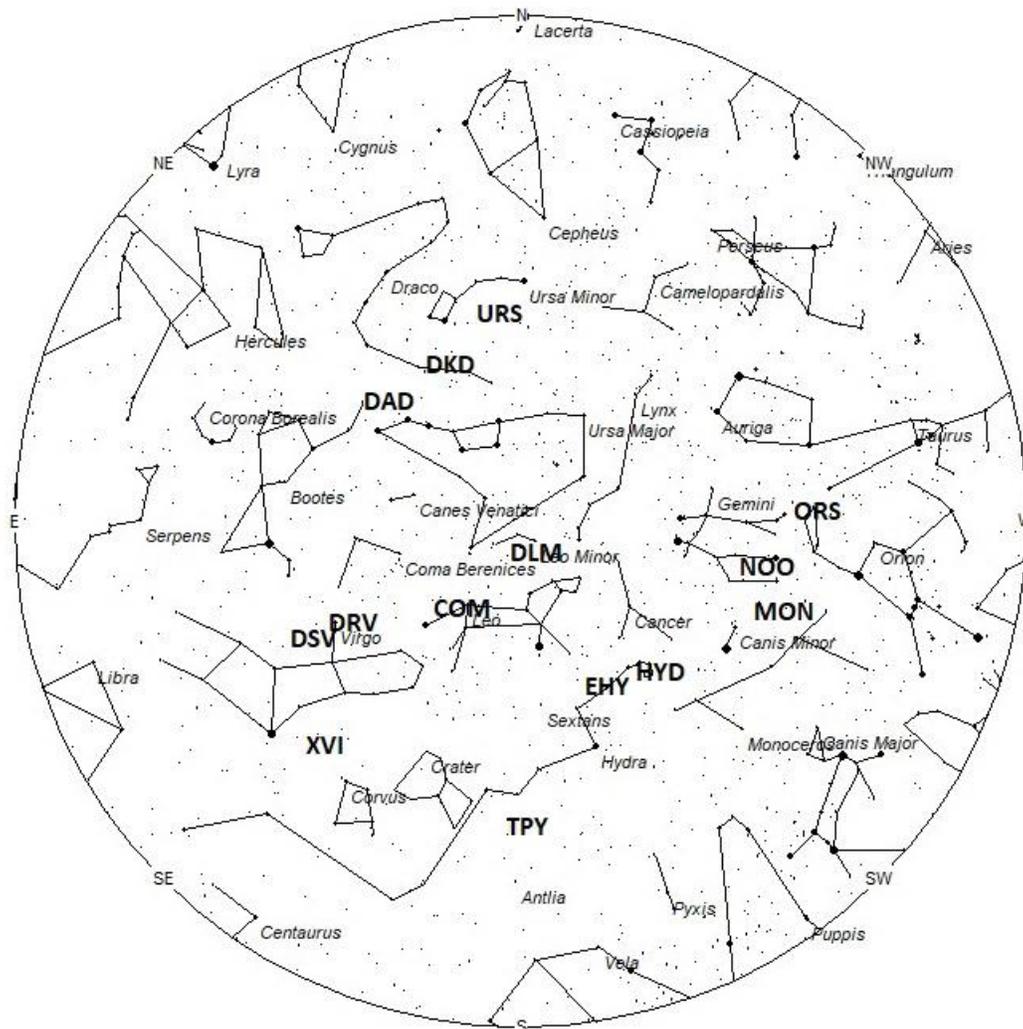
During this period, the moon waxes from its first quarter phase to nearly full. This weekend the waxing gibbous is in the sky during the evening hours and sets just after midnight local standard time. As the week progresses the moon will set approximately 45 minutes later each night and by the end of the week it will be above the horizon all night long. The estimated total hourly meteor rates for evening observers this week is 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 40 as seen from mid-northern latitudes (45N) and 20 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 during this period due to interfering 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 11/12. 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





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.**

The **Southern chi Orionids (ORS)** are active from November 14 through December 16, with maximum activity occurring on December 2<sup>nd</sup>. The radiant is currently located at 05:48 (87) +18, which lies on the Taurus/Orion border, 2 degrees southwest of the 4<sup>th</sup> magnitude star known as chi 1 Orionis. This radiant is best placed near midnight LST, when it lies on the meridian and is located highest in the sky. Rates at this time should be near 3 per hour as seen from the Northern Hemisphere and 2 as seen from south of the equator. Note that this radiant lies too close to the anthelion radiant to separate by visual means. The Anthelion radiant will be posted once the ORS activity has ended on December 16<sup>th</sup>. These rates are a combination of the two sources. With an entry velocity of 26 km/sec., the average ORS meteor would be of medium-slow velocity.

The last of the **November Orionids (NOO)** are expected this weekend. The radiant is currently located at 06:40 (100) +14. This area of the sky lies on the in western Gemini, 2 degrees 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. Rates should be less than 1 per hour no matter your location. With an entry velocity of 41 km/sec., most activity from this radiant would be of medium speed.

The **Monocerotids (MON)** are active from November 23 through December 24 with the peak activity occurring on December 11<sup>th</sup>. The radiant is currently located at 06:47 (102) +08. This position lies in northern Monoceros, near the spot occupied by the faint star known as 17 Monocerotis. This position is only 6 degrees south of the radiant of the November Orionids so care must be taken to distinguish between the two. Current rates should be near 2 per hour as seen from the Northern Hemisphere and near 1 as seen from south of the equator. 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 **Geminids (GEM)** reach maximum activity on the night of December 13/14 with the radiant located at 07:34 (114) +32. This position lies in northern Gemini, near the spot occupied by the 2<sup>nd</sup> magnitude star known as Castor (alpha Geminorum). Rates this weekend should be near 20 per hour as seen after moonset from the Northern Hemisphere and near 5 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 1<sup>st</sup>. The center of this activity is currently located at 08:24 (126) -45. This position lies in western Vela, 2 degrees southwest of the 4<sup>th</sup> magnitude star known as e Velorum. Peak rates occurred 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 08:34 (128) +02. This area of the sky is located in western Hydra, 1 degree southwest of the 4th magnitude star known as sigma Hydrae. 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 58 km/sec., the average sigma Hydrid meteor would be of swift velocity.

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 09:02 (135) +02, which places it in western Hydra, 2 degrees west 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 0300 LST when the radiant lies highest above the horizon. Current rates should be near 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)** consist of two weak showers that peak two weeks apart. The later version is now active from December 8 through January 8 with maximum occurring on December 18. The radiant is currently located at 09:52 (148) -23. This area of the sky is located in southwestern Hydra near the spot occupied by the faint variable star known as Y Hydrae. These meteors are best seen near 0400 LST when the radiant lies highest above the horizon. Current rates are expected to be less than 1 per hour no matter your location. At 62 km/sec. the theta Pyxids would produce mostly swift meteors.

The **December Leonis Minorids (DLM)** are a shower of long duration active from December 1<sup>st</sup> all the way through February 10th. Maximum occurs near December 19th when rates may reach 3 an hour. During this period, I would expect hourly rates of 2 from a radiant located at 10:16 (154) +34. This position lies in central Leo Minor, 2 degrees southeast of the faint star known as 21 Leonis 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. These meteors are known most commonly as the Comae Berenicids.

The **Comae Berenicids (COM)** are active from December 12-23, with maximum activity occurring on the 16<sup>th</sup>. The radiant for this source currently lies at 11:19 (170) +21. This area of the sky lies in eastern Leo, 1 degree northeast of the 3<sup>rd</sup> magnitude star known as Zosma (delta Leonis). This area of the sky is best placed near 06:00 LST, when the radiant lies highest in the sky. Current rates would be near 1 per hour as seen from the northern hemisphere and less than 1 as seen from south of the equator. At 65 km/sec. the Comae Berenicids produce mostly swift meteors.

The **December chi Virginids (XVI)** are another shower discovered in Japan by observers using data from SonotaCo. This source is active from November 26 through December 30 with maximum occurring on December 12<sup>th</sup>. The radiant is currently located at 12:38 (189) -09, which places it in southwestern Virgo, 1 degree south of the faint star known as chi 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 horizon in a dark sky. At 68 km/sec. the December chi Virginids would produce mostly swift meteors.

The **Ursids (URS)** are active from December 13-24 and peak on the morning of December 22<sup>nd</sup>. The radiant is currently located at 12:43 (191) +77. This area of the sky is located in northeastern Camelopardalis, 8 degrees northwest of the 2<sup>nd</sup> magnitude star Kochab (beta Ursae Minoris). This area of the sky is best seen during the last hour before dawn. Current rates are expected to be less than 1 no matter your location. At 37 km/sec. this source would produce mostly medium speed meteors.

The **December rho Virginids (DRV)** are active from November 29 through December 22 with peak rates occur near December 5th. The current radiant location is at 12:46 (192) +12 which places it in northeastern Virgo, 3 degrees northwest of the 3<sup>rd</sup> 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 horizon in a dark sky. At 68 km/sec. the December rho Virginids would produce mostly swift meteors.

The **December kappa Draconids (DKD)** were discovered by SonotaCo during studies of new radiants in 2008-2009. This shower is active from November 29 through December 13 with maximum activity occurring on December 3rd. The radiant is currently located at 13:18 (199) +66. This position lies in western Draco, 5 degrees northwest of the 4<sup>th</sup> magnitude star known as Thuban (alpha Draconis). While the radiant lies above the horizon all night for most of the northern hemisphere, it is best placed during the last hour before dawn, when it lies highest above the horizon in a dark sky. Current hourly rates are expected to be less than 1 no matter your location. Due to the high northerly declination of the radiant these meteors are not visible from most of the southern hemisphere. At 43km/sec., the average December kappa Draconid meteor would be of medium velocity.

The **December sigma Virginids (DSV)** is a source of long duration discovered by John Greaves using the data of SonotaCo. This source is active from November 26 through January 24 with peak rates occur near December 21st. The current radiant location is at 13:16 (199) +07 which places it in northern Virgo, 4 degrees southeast of the 3<sup>rd</sup> 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 horizon in a dark sky. At 66 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 13:43 (206) +57. 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 less than 1 per hour no matter your location. 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 interfering moonlight during this period.

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 available at: <https://meteorshowers.seti.org/> 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.

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	
Southern chi Orionids (ORS)	Dec 02	05:48 (87) +18	26	00:00	3 - 2	IV
November Orionids (NOO)	Nov 30	06:40 (100) +14	41	01:00	<1 - <1	II
Monocerotid s (MON)	Dec 11	06:47 (102) +08	41	01:00	2 - 1	II
Geminids (GEM)	Dec 14	07:34 (114) +32	34	02:00	20 - 5	I
Puppilid- Velids (PUP)	Dec 07	08:24 (126) -45	40	03:00	<1 - 2	II
sigma Hydrids (HYD)	Dec 07	08:34 (128) +02	58	03:00	2 - 2	II
eta Hydrids (EHY)	Dec 12	09:02 (135) +02	62	04:00	1 - 1	II
theta Pyxidids (TPY)	Dec 01	09:52 (148) -23	61	05:00	<1 - <1	IV
December Leonis Minorids (DLM)	Dec 19	10:16 (154) +34	63	05:00	2 - 1	II

Comae Berenicids (COM)	Dec 16	11:19 (170) +21	65	06:00	1 - <1	II
December chi Virginids (XVI)	Dec 12	12:38 (189) -09	68	07:00	1 - 1	IV
Ursids (DRV)	Dec 22	12:43 (191) +77	37	07:00	<1 - <1	I
December rho Virginids (DRV)	Dec 05	12:46 (192) +12	68	07:00	<1 - <1	IV
December kappa Draconids (DKD)	Dec 03	13:18 (199) +66	43	07:00	<1 - <1	IV
December sigma Virginids (DSV)	Dec 21	13:16 (199) +07	66	08:00	<1 - <1	IV
December alpha Draconids (DAD)	Dec 08	13:43 (206) +57	44	09:00	<1 - <1	IV