

**Web Chat: Stay 'Up All Night' to Watch the Perseids!**  
**Experts Dr. Bill Cooke, Danielle Moser and Rhiannon Blaauw**  
**August 10, 2013**

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*danielle\_moser*: We are having some technical difficulties right now. Hopefully we'll work through them shortly. Thanks for your patience...

Mike\_D: What time is the peek on the west cost

*danielle\_moser*: The best time to view Perseids in the hours just before dawn when the radiant is the highest in the sky.

unkle bones: can this be seen from easter ohio?

*bill\_cooke*: Yes, it can.

booger: Will this shower repeat as others do on a yearly basis? Thank you for your time!

*danielle\_moser*: The Perseids occur each year in August at this time.

sethyaboi: Can you see this from Layton Utah?

*bill\_cooke*: It can be seen anywhere in North America and Europe.

suse: Would it hurt if I were hit by one of these meteors?

*danielle\_moser*: Perseids burn up completely in the atmosphere. You won't get hit by one. ☺

Rusty\_Shakleford: exactly how much of a threat do meteor showers pose to say satelites or the ISS?

*bill\_cooke*: Meteor showers pose little risk to satellites or ISS. Meteor outbursts or storms, which are much more intense, can pose a risk.

*moderator\_brooke*: Hi everyone -- again, thank you so much for your patience in getting our chat going. Can we write this off to gremlins? ☺

kaylan: im in quebec, canada, did it started over there?

*danielle\_moser*: You can see Perseids from Quebec if you have clear skies.

bluntheart: How does NASA predict these showers?

*bill\_cooke*: We simulate particles ejected from the comet and see when these particles will cross the Earth's orbit. This tells us when the shower will occur.

Carlos: About how far from Earth will these meteors be?

*bill\_cooke*: They're hitting Earth's atmosphere. Most Perseids burn up by 55 miles above Earth's surface. No known Perseid has impacted Earth's surface.

GravitationalEddie: Info on camera location and orientation?

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*bill\_cooke*: Camera is located at Marshall Space Flight Center in Huntsville, Alabama. It has approximately 16x21 degree field of view and is pointed north.

Jasper: Hey! What's the sort of time frame (annual or more/less common?) for this type of meteor shower?

*danielle\_moser*: The Perseids are generally active between July 17 and August 24 -- but they peak August 12. August 11-13 is usually pretty good for observing Perseids if you have clear skies.

Lance: Are the things that look like static on the stream stars?

*bill\_cooke*: Yes. The skies above Huntsville are fairly hazy right now.

Mike\_hales: Anyone see any?

*danielle\_moser*: We've seen at least one with our meteor camera network so far tonight. 😊

Dr. Goozoo: Anyone know what the composition of Swift–Tuttle is?

*bill\_cooke*: Ice and dust, a "dirty snowball."

kaylan: did it started yet?

*danielle\_moser*: You should begin seeing fireballs around 10:00 pm local time. Best in the early morning hours.

Liz: What would be a good time to watch from NY?

*bill\_cooke*: Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

todd: I have already seen 13 over eaton ohio

*bill\_cooke*: Awesome!

xander: how close do the meteors get to earth's surface

*bill\_cooke*: Over 99.9 % burn up miles above the surface.

pk: Approximately how fast are the meteors going?

*danielle\_moser*: Perseids travel 59 km/s or 132,000 mph. This is almost 100 times faster than the Concorde jet!

David: What is our field of view on the live stream camera (measured in degrees)?

*danielle\_moser*: 16x21 deg

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ohwowits11: What importance do meteor showers have further than being visually interesting?

*bill\_cooke*: From an engineering perspective, meteor storms or outbursts are important to study as they pose a risk to satellites and spacecraft.

xander: how do i get a job at nasa studying meteors

*danielle\_moser*: Are you a student? We generally have 1-2 student interns each semester studying meteors.

RapeBoiz: How often does this happen?

*bill\_cooke*: The Perseids occur every August. Meteors can be seen every clear night - up to eight per hour when there are no meteor showers.

*moderator\_brooke*: Thank you for your patience as our experts answer your questions. We have a lot in the queue tonight. Thankfully the skies have cleared, and we currently have a good view of the skies over Marshall Space Flight Center.

BackApple: What time PDT does this start?

*danielle\_moser*: You should begin seeing Perseids around 10-10:30pm your local time. But the rates will be better in the hours just before dawn.

gholtorf: What is the direction and field of view of the camera?

*danielle\_moser*: It's 16x21 deg and pointed North.

butch614: I am struck by all the blinking which I assume is stars and only one planet?

*danielle\_moser*: Yes, the stars are twinkling. ☺

Reece: So how are the Perseid showers tonight versus year's past?

*bill\_cooke*: This year's Perseids are good visually since the moon sets in the early evening. The rates tonight will be less than half of the peak rates which will be between 60-100 per hour on the nights of August 11/12 and 12/13.

JOBIX: ARE you able to see them in pittsburgh pa

*danielle\_moser*: If you've got clear, dark skies -- yes!

wanman: Do you have any suggestions about photographing meteor shows?

*bill\_cooke*: Meteors can be photographed if you have a long-exposure camera. Set a 5-10 minute exposure.

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BW3127: twice I saw a solid light travelling up/down the middle of the screen -- meteors? Planes?

*bill\_cooke*: Could be either. Meteors will be much faster than planes in the live feed.

Reece: At this time in the Boston area, should we be looking northeast?

*danielle\_moser*: If it's not cloudy, get as far away from bright lights as you can, lay on your back and look up. You don't need to look in any particular direction -- just up!

BWilly: What time is the Perseids?

*bill\_cooke*: Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

persiods: has there been an increase in meteor activity to this point tonight?

*danielle\_moser*: Yes, the Perseids have been ramping up. Check out observer reports on [www.imo.net](http://www.imo.net). They've got a graph of activity on the main page. You can see the increase in time.

starbreeze: Is there a chance of an outburst or storm with this shower?

*bill\_cooke*: No, the Perseids have never stormed. The last Perseid outburst was in 2009 and next is expected in 2016.

Jasper: What was the first instance that people noticed the perseids?

*bill\_cooke*: They are first recorded in Chinese annals in 36 A.D. Though credit for the discovery for the showers annual appearance was not until 1835 until it was identified that these meteors emanated from the constellation Perseus.

Dave: If I walk outside atm would I be able to see some of this? Virginia

*danielle\_moser*: Yes, but you'd probably have better luck between 3 and 5 am local time tonight. And if that doesn't work out, the Perseids actually are expected to peak tomorrow night. 😊

xander: is it viewable in south eastern michigan

*bill\_cooke*: Yes, observable all over the world except the Antarctic, southern parts of South America and southern parts of Australia.

mymonka: Where should we look for the new meteor shower and how will we know it from the Perseids? I am in the southwest.

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*danielle\_moser* : Sorry, we're talking about Perseids tonight. There has been some confusion because the automated blurb when you sign into the chat room talks about the gamma delphinids -- that was the LAST chat we had. The blurb is an error.

*rubyjswiney*: Hi! My five year old future scientist would like to know what are meteors made of? And how far are these meteors away from the earth? Thank you so much!

*bill\_cooke*: A mixture of ice and dust with some organic chemicals. The meteors are in Earth's atmosphere, most burning up by 55 miles above the surface.

*TRose2342*: What is that radio station you have on in the live feed?

*bill\_cooke*: NASA's Third Rock Radio.

*xander*: does this occur every august

*bill\_cooke*: Yes. Every August Earth moves through a stream of debris left by Comet Swift-Tuttle. That's when we see the Perseids.

*xander*: How large is an average meteor?

*danielle\_moser*: Meteoroids are typically sand grain to pebble-sized. Meteors -- the light streaks created when meteoroids travel through the atmosphere -- are millions of times the size of the meteoroid.

*Baron\_Harkonnen*: What direction in the sky should we be watching?

*bill\_cooke*: Lie on your back and look straight up. Let your eyes adjust to the dark, which can take up to 45 minutes. And enjoy!

*contranton*: So there are no chances for viewing in the Santiago Chile area?

*danielle\_moser*: You need to be north of the 32 deg South latitude line to see Perseids.

*Alyssa*: Why do the perseids have more fireballs than any other meteor shower?

*bill\_cooke*: The stream of debris left by Swift-Tuttle is more dense at the part we are going through it than the stream of debris from other comets producing other meteor showers.

*le 4chin*: Can this be seen from the southern hemisphere?

*bill\_cooke*: Yes, though not the Antarctic, southern parts of South America and southern parts of Australia.

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*moderator\_brooke*: Thanks for all of the great questions. Don't forget, if you have some images of this weekend's Perseid shower, feel free to share them at our Flickr group:

<https://www.flickr.com/groups/perseids/>

*trishaaaa*: what is the best elevation to see the meteors from?

*danielle\_moser*: You don't have to travel up to a mountaintop to see Perseids, though that can help you get away from clouds and light pollution.

9879879798: What size lens is used on the camera used for this live feed?

*bill\_cooke*: A 17 mm Schneider lens.

*peter*: Hi. Can we get a quick orientation about live feed. Are we looking toward Neptune and the Dolphin?

*bill\_cooke*: The camera is pointed north 60 degrees above the horizon.

*Jasper*: What makes the Perseids more fascinating/different than other showers?

*danielle\_moser*: They are a good show every year -- they are consistent and produce lots of fireballs. ☺

*JackalBear*: How far outside a city like Minneapolis should you be to view these showers effectively? I am hoping to view them tomorrow.

*bill\_cooke*: If you can get far enough from the city to be able to see all the stars of the Little Dipper, you have pretty good dark skies.

*Jennifer*: I'm watching the ustream live view right now. When can I expect to start seeing some meteors?

*danielle\_moser*: You can see them now. But patience is the key. And coffee! ☺

*ssd*: Is there a playlist of the music on the stream?

*danielle\_moser*: You are listening to Third Rock Radio.

*bobbistef*: what direction will they be coming from on the west coast

*bill\_cooke*: The Perseids all appear to emanate from the Constellation Perseus, however the meteors will be seen all over the sky, so the best way to view is to just look up.

*Jasper*: Don't know much anything about space, but thanks for making all this accessible to the public! You guys are doing a great job.

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*bill\_cooke*: Thanks so much for the feedback!

Reece: Would everyone be seeing the same meteors as you from Huntsville or are we seeing different meteors?

*bill\_cooke*: Depending on where you are. It is possible to see the same bright meteor from up to 200 miles away.

David: How far back in time are we looking in this camera view? How many light-years away are some of these stars?

*danielle\_moser*: You are viewing a live view of the sky over Huntsville, Alabama. But I've not identified the stars in the field of view currently (too busy answering questions!), so I'm sorry that I can't comment on how far away they are.

13hufflepuff: How were the speed of the meteors determined?

*bill\_cooke*: Triangulation. If we can detect the same meteor on two or more cameras in different places, we can calculate the meteor's speed, orbit and other quantities.

awesome-o: when's the best time to see it over Northern California?

*bill\_cooke*: Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

spwinny: Thank you so much for doing this, grandkids gathered for the show.

*bill\_cooke*: Fantastic!

Jennifer: When where the Perseids first observed?

*danielle\_moser*: The earliest record of Perseids comes from around 36 AD --- in Chinese historical documents.

affan\_s: Is there a chance that a meteor can hit the surface if it doesn't burn up 100%

*bill\_cooke*: Yes. If a meteor reaches the Earth's surface, it is now considered a meteorite.

Caramel: What time will the meteors happen during your stream?

*bill\_cooke*: Hopefully, any time that we have clear skies. We are dealing with sporadic clouds. If you can not see stars in the field-of-view, it is likely that clouds have covered the sky. Even when we have breaks in the clouds, we have a fairly hazy sky.

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trishaaaa: Since its the 10th, will we see any tonight or are chaces better around 4 am tomorrow morning?

*danielle\_moser*: If it's clear you'll be able to see Perseids tonight (Aug 10)/tomorrow morning (Aug 11). But the Perseids are expected to peak on Aug 12 -- that's tomorrow night (Aug 11) into the following morning (Aug 12). And they'll still be fairly active Aug 13.

mkmudder: What is an 'outburst'?

*bill\_cooke*: An outburst is when we see more than normal rates. A meteor storm is when you see a 1000+ plus meteors per hour.

affan\_s: The comet swift-tuttle orbits the sun every 133 years. How can the Earth always pass through the dust every August when the comet will be in a different location (or is it the same location).

*bill\_cooke*: There is dust deposited throughout the comet's orbit, so even when the comet is far from us, we can still pass through dust left on previous apparitions.

kronos: has the event started? or will the live viewing be whats already on ustream?

*bill\_cooke*: Yes. Though the peak of the shower will not be until August 11/12 and 12/13. On those nights, if you have clear dark skies, you can see between 60 and 100 meteors per hour. Tonight you will see less than half of those rates.

affan\_s: How do we know we are far away from the city and light pollution.

*bill\_cooke*: If you are able to see all the stars in the Little Dipper, you have fairly good dark skies.

Baron\_Harkonnen: So, it's not the size of the particles that make them potentially dangerous, it's the incredible speed?

*danielle\_moser*: Yes! It's the combination of mass and speed that makes them potentially dangerous, but speed counts more.

canalzorn: How hot do they get when they enter the atmosphere?

*danielle\_moser*: 2000-6000 Kelvin

AragonRed: I'm in Pearland, Texas...do you think I will be able to see this awesome celestial event from here?

*danielle\_moser*: If you've got clear, dark skies - yes!

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Chemistry66: Since the 11th into the 12th is supposed to be the peak, how late (or technically early in the morning) is recommended to watch then? (Coming from southern MI)

*bill\_cooke*: The ideal time would be the hours before dawn (3 a.m. to 5 a.m.), though you should be able to see meteors any time after 10 p.m.

prostaffer: Is there any special direction we should be viewing most,,north, south, etc

*bill\_cooke*: No. Lie on your back and look straight up. Give your eyes time to adjust to the dark.

Dharvey3232: are you located at the space center in Florida or the one in huntsville?

*bill\_cooke*: Located at Marshall Space Flight Center in Huntsville, Ala.

canalzorn: How large is the comet that the meteors are coming from?

*danielle\_moser*: The Perseid parent body is comet Swift-Tuttle. The comet's nucleus is 26-27 km (16-17 miles) in diameter.

wanman: What advancements have been made in the protection of spacecraft and satellites from meteors?

*bill\_cooke*: Each satellite can decide how much protection it wants to put on itself from meteors. The International Space Station is armored with "stuffed bumper shields," that can protect from meteoroids up to 1 inch in diameter.

GrayMatter4tw: I saw one while driving home about an hour ago, in the northmernmost part of the upper peninsual of Michigan, very little light pollution up here! Is now the best time?

*danielle\_moser*: Awesome!!! Tonight you'll see more Perseids in the hours before dawn, 3-5am local time. But the Perseids are expected to peak the night of Aug 11-12.

Debbie: I have a hard time trying to look at them but saw at least 5 last night. Going outside shortly. I am in FL

*danielle\_moser*: Remember to give your eyes time to adjust to the dark -- it takes 30-45 minutes.

lissa: will there be a replay on ustream.. if i dont make it. :)

*bill\_cooke*: One way to see Perseids will be to check our web site [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov), where the videos of meteors seen with our all-sky cameras are posted.

Catch22: Is this the largest of the meteor showers?

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*danielle\_moser*: The Perseids and the Geminids (in December) both have high meteor rates.

Hpatps1: Where do these particular meteors come from?

*bill\_cooke*: Comet Swift-Tuttle.

Starr: How fast do these meteors travel?

*bill\_cooke*: 130,000 miles per hour.

zrestorick: This has ignited my son's interest in science and space. We have been all over the NASA website tonight and he is absolutely fascinated! And I am enjoying this amazing experience as well. Thank you so much. What an incredible way to share!

*bill\_cooke*: You are so welcome!

Lisa: When can we watch the shower online?

*danielle\_moser*: You should be able to see the live camera feed from Huntsville, Alabama tonight through Monday morning. And if you miss that, check out our fireball videos each day at [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov)

Dharvey3232: how can you tell which direction the meteors are traveling in relation to the earth's rotation?

*bill\_cooke*: If we see the same meteor in two or more cameras at different locations, we can calculate the meteors speed, trajectory and other information. We can even determine where in the solar system the meteor came from.

njgmoorman: Is it possible to see the meteors during broad daylight?

*bill\_cooke*: Not visually. Meteor radars are not hampered by daylight and can detect 24 hours per day.

*moderator\_brooke*: Thank you for your patience as our experts answer your questions. Lots of great feedback tonight!

spaceghost: It must be scary to be on the ISS during such a large meteor shower. Are there any precautions that they have to take?

*bill\_cooke*: The ISS armor will stop anything less than an inch in diameter. The ISS is well-protected. The concern is with astronauts. A spacesuit can be penetrated by a millimeter-sized particle. A 1 millimeter-sized particle has the punch of a .22 caliber bullet, so you don't want astronauts going out during increased activity.

Hubert: Is this an "outburst"?

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*bill\_cooke*: We expect normal Perseid rates this year. The next predicted outburst is 2016.

trishaaaa: What is the largest meteor we could see?

*bill\_cooke*: Most meteors you see are from particles millimeter to centimeter size. The streak of light is millions of times the size of the meteor.

njgmoorman: How fast are they going?

*bill\_cooke*: 130,000 miles per hour.

Worcester: What are the chances that a meteor will make it all the way through the atmosphere and hit the earth?

*bill\_cooke*: The chances of a Perseid hitting the Earth's surface are little to none. Most are completely burned up by 55 miles up. However, sporadic (background) meteors become meteorites on a daily basis.

njgmoorman: What would happen if the Swift-Tuttle were to crash to Earth?

*bill\_cooke*: Swift-Tuttle is twice the size of the asteroid that eliminated the dinosaurs and has 10 times the kinetic energy. So it would not be good.

Pancake\_High: Will they be as bright as the Lyrids were earlier this year?

*bill\_cooke*: In terms of brightness, they are comparable. However, Perseids have higher rates.

mdem: what exactly am i supposed to be looking for in this ?

*bill\_cooke*: In the live feed, look for streaks of light. If you go outside, do the same. Lie on your back, look straight up and let your eyes adjust to the dark.

Jordanthestorm: Has it already started?

*bill\_cooke*: Yes, we have already seen many Perseids.

njgmoorman: Is there any particular constellation to look near/

*bill\_cooke*: No, just look up.

tina g: Thanks to NASA for sharing the live feed. I live in the Monterey Bay area, and it is perpetually overcast at night here.

*bill\_cooke*: You are so welcome!

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bloobadger: what is the average size of these meteors? (thanks for being so attentive to the questions)

*bill\_cooke*: The average size you will see with your naked eye are millimeter to centimeter-sized particles.

Dharvey3232: I'm with my college astronomy club half way between montgomery and birmingham in the darkest place in the country we could find. we are seeing only a few small meteors. what kinds of data can we take for research (sorry I'm getting a lot of questions at one time)

*bill\_cooke*: Go to [imo.net](http://imo.net) to report visual observations. We hope you see lots!

Jasper: You all keep saying 3-5 am local time to people whom I assume are from different areas- so how does time zone arrangement work with when these meteors can be viewed around the world?

*danielle\_moser*: For meteor outbursts and storms, the trail of comet debris is very narrow, and it only takes a few hours for the Earth to pass through the stream. This isn't enough time for the Earth to go through a full rotation, so only people in areas where it's night and the radiant is visible will be able to see an outburst/storm. You've got to be in the right place on Earth to see outbursts/storms. The Perseid stream, however, is quite wide -- it takes days for the Earth to cross it. So longitude doesn't really matter. Most of the Earth (places north of 32 deg South latitude) can view the radiant when it's dark/clear -- so they can see Perseids. The altitude of the radiant depends on your latitude and time of day. The radiant altitude climbs during the night and is highest in the hours before dawn (you'll likely see the most Perseids when the radiant is high in the sky). That's why we keep quoting 3-5 am local time.

Reece: Approximately how long is the streak one sees when the meteor goes across the sky?

*bill\_cooke*: Seconds long.

ifishwi: Still want to know, what are the Persied metorites made of?

*bill\_cooke*: The particle is made out of ice and dust.

SCooper: What is the current location of Comet Swift-Tuttle and what is the average size of the particles that will be entering our atmosphere over the next couple of nights?

*bill\_cooke*: Swift-Tuttle is currently 34 times Earth's distance from the Sun. The meteors you see are from particles millimeter to centimeter size.

Baron\_Harkonnen: Last August, I would swear I saw a metiior through my car windshield while driving in the country. Is this possible?

*bill\_cooke*: Absolutely. I have seen several meteors while driving.

njgmoorman: Is ISS in any danger of being hit and hypothetically, if it did get hit, what would happen?

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*bill\_cooke*: Yes. The International Space Station is constantly bombarded by tiny particles, but it is extremely unlikely that it will be hit by anything large enough to penetrate its armor.

Josh\_Burt: Hey! I know Fireballs has a limiting magnitude of around -3... how does this compare to human visual acuity?

*danielle\_moser*: Hey Josh! Several orders of magnitude different: +6 is generally the limit for human eyes

njgmoorman: How big was the meteorite that hit Russia?

*bill\_cooke*: The meteor was from an object school bus-sized.

scholarbowlchicka: Did I miss the most of it?

*bill\_cooke*: No! The best rates will be tomorrow night, specifically in the hours before dawn.

Dharvey3232: where did the names "Perseids" and "swift-Tuttle" originate?

*bill\_cooke*: The Perseids are named from the constellation that it's radiant (the point in the sky that the meteors appear to come from) is located - which is Perseus. Swift-Tuttle is named after the people that discovered it.

AragonRed: this proolly a stupid question...but any chances of them hitting out satelllites?

*bill\_cooke*: The chance is quite low, though it has happened. In 1993, the satellite Olympus was lost due to a Perseid.

bloobadger: are all of the meteors the same "material"? if so, what are they made up of?

*bill\_cooke*: All Perseids are, yes. Though there are various classifications for the composition of meteorites.

mkmudder: This chat is very informative, thank you for taking the time. Hopefully, I'll have all my daughter's answers while we lay under the stars tomorrow nite

*bill\_cooke*: You are welcome!

awesome-o: what sparked your interest in studying meteors professionally?

*danielle\_moser*: I've always been interested in astronomy. Meteors were something close to home -- some thing I had a feel for, as opposed to stars and galaxies far, far away. I got started with meteors/meteoroids while in college -- the Leonids were a big deal then. ☺

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holycowe: Will go out with my 2 daughters now. Where should I look? We're in Las Vegas, NV. Thanks

*bill\_cooke*: Lie on your back, look straight up and allow time for your eyes to adjust to the dark.

Chemistry66: The live stream is much appreciated since I'm in too much of a light-polluted area to see anything outside.

*danielle\_moser*: Glad you can enjoy them through the live stream!!! Also check out Perseid fireball videos posted each day at [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov)

BLC: What's the expected ZHR max of this years shower?

*bill\_cooke*: Approximately 100.

stargazerr21: even though its not its peak will i still many Perseids?

*bill\_cooke*: You may see as many as 30 per hour before dawn.

stargazerr21: Even though its not peak night will i still be able to see meteors?

*bill\_cooke*: Yes, but fewer than tomorrow night.

StarGazer420: what type of duration (per meteor) can we expect to see?

*bill\_cooke*: Less than 2 seconds in general.

ax25: So, the meteors are made of dust. But what is in the dust? Is it anything specific, or do we not have enough from Swift-Tuttle to know?

*bill\_cooke*: Various elements like carbon, silicon, olivine.

rollins: when is the meteor shower officially over? I'm travelling on a night flight later in the week I would imagine that would be a good place to see meteors if they are still going on

*bill\_cooke*: You won't see many after Tuesday night.

AragonRed: Will this event help us understand what happened in Russia about 4 months ago?

*danielle\_moser*: The Chelyabinsk fireball was caused by a small asteroid. It was an isolated event. Very different from the Perseids -- a meteor shower that occurs every year when the Earth travels through streams of small particles left behind by comet Swift-Tuttle.

spaceghost: Does the length of time that a meteor is visible to us depend on the size or the speed of the meteor? Or both?

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*bill\_cooke*: Both. A large, slow-moving meteor will be visible longer than a small, fast meteor.

CCRocks: Is it true that the reason it is called the Perseids meteor showers, is due to the fact that the earth at this time is passing through the constellation Perseus?

*bill\_cooke*: No. The Perseids appear to radiate from the Constellation Perseus, but we are many, many light-years away from the stars of that constellation. The Perseids seem to come from that direction due to their motion around the Sun.

StarGazer420: so would these meteors be hitting earth at all? or no since they are just dust and ice? do they have ANY remnants of metals in them?

*bill\_cooke*: They do not hit the Earth, but ablate 50 to 60 miles above your head. And, yes, there are small traces of metals which are deposited in the upper layers of the atmosphere when the meteor burns up.

stargazerr21: I live in central IL will i be able to see meteors tonight?

*danielle\_moser*: Yes, if you've got clear, dark skies. The Perseids actually peak Aug 11-12, so you've got another chance if you miss it tonight. ☺

njgmoorman: how could you possibly tell 1) What the particles are made of, 2) Where they came from, 3) How fast they're going?

*bill\_cooke*: Perseids are made of dust and ice from Comet Swift-Tuttle and hit the atmosphere moving at 132,000 miles per hour.

.

BLC: If the Swift-Tuttle has an orbital period of 133 years, how is the Perseid meteor shower visible each year?

*bill\_cooke*: Because the orbit passes close to the Earth and Earth intersects that point each year. The comet orbit is filled with dust which we encounter in mid-August when Earth comes close.

njgmoorman: About when did these pieces of debris break off the comet?

*bill\_cooke*: Hundreds of years ago.

Kenzie\_21: about how many meteors would i see tonight in an hour?

*bill\_cooke*: Depends on your time zone.

Dharvey3232: are there shots from the ISS that are being taken of the perseids as they enter the atmosphere over the next few days and will we be able to see them over the internet?

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*bill\_cooke*: Not as far as we know. Up to the astronauts.

StarGazer420: what is the difference between a meteor, a meteorite, and an asteroid?

*danielle\_moser*: METEORIDS are chunks of rock and ice out in space. They are about the size of a boulder or smaller. They aren't quite big enough to be an ASTEROID. METEORS are the streaks of light that you see as a meteoroid ablates, or burns up, in the atmosphere. They're commonly called shooting stars or falling stars. METEORITES are what is left of the meteor/meteoroid if it hits the surface of the Earth.

ChaosDesigned: Given a decent amount of visibility in the night sky, how well should you be able to see them from the West Coast tomorrow before Dawn?

*bill\_cooke*: If you are away from lights, it should be pretty good.

CCRocks: Living in a city in CT, what would you suggest be the best way to view these showers during this current period?

*bill\_cooke*: If you can't get out of the city, go somewhere where you are shielded from lights and lie on your back and look straight up.

mstwolf: Hi Bill =) I'm currently listening to the meteors on space radio. However, when I go outside to watch them, I don't see as many as I hear. Is this due to the size of the meteors?

*bill\_cooke*: Yes. Space radio detects smaller meteors than you can see and there are more of these.

TomCat: When did Swift Tuttle last orbit the sun? Are the meteors we are seeing tonight from that last orbit or from a prior orbit around the sun?

*bill\_cooke*: It last came close to the Sun in 1993 and the meteors you see tonight are from several orbits ago.

Kenzie\_21: will I see meteors tonight even though its not a peak night?

*bill\_cooke*: Yes, but not as many as tomorrow night.

Kenzie\_21: will i see meteors tonight even though its not a peak night?

*bill\_cooke*: Yes, you will.

acme: Does this radio have its own link?

*danielle\_moser*: <http://thirdrockradio.rfcmedia.com/>

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SoonieKoo2: On Twitter I saw a photo taken from the ISS, looking down on the meteor shower. How high above Earth is the ISS? How high above Earth are the meteors?

*bill\_cooke*: ISS is 400 kilometers above the Earth. Perseids burn up at altitudes of 80-90 km.

pete: Where in the far east was the first Perseids meteor shower recorded?

*danielle\_moser*: China, as far as I know

Jhan: Will we see the meteor on the west coast, particularly Southern California? If so, where can I look to find it?

*bill\_cooke*: Find a dark sky and look straight up. You will see Perseids. But tonight is not the best night. The peak is tomorrow.

sillywoman: Are the perseids visible from the ISS?

*danielle\_moser*: The Perseids have been imaged from ISS in the past! Check out this image:  
<http://apod.nasa.gov/apod/ap120810.html>

vohpoh: So, are the Persieds moving into the Earth or is the Earth moving into the Perseid?

*bill\_cooke*: It's all relative. Both bodies orbit the Sun. Who runs into who is your choice.

...: what does ZHR stand for?

*bill\_cooke*: ZHR stands for zenithal hourly rate and gives a theoretical measure of the intensity of the meteor shower.

Philo: how wide a view is the streaming camera? It seems very narrow. I usually scan a good 60-80 degrees of sky when outside.

*bill\_cooke*: 21x16 degrees field of view. It is a low-light level video camera.

Kenzie\_21: How many meteors would i see per hour on a peak night?

*bill\_cooke*: If you have clear, dark skies, 60-100.

Alyssa: Why are some meteors different colors? Is it because of how fast they burn up in the atmosphere?

*bill\_cooke*: Meteors can be orange, yellow, white, green, etc. It may be due to the chemicals being released in the atmosphere, though can also be based on the way our eye perceives them.

CCRocks: Are meteors and "Shooting Stars" the same thing?

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*bill\_cooke*: Yes.

dakadama: i am thinking of going out tuesday morning around 4 AM. do you think i will have a better chance of seeing any then?

*bill\_cooke*: Yes. If your skies are clear, you should see higher rates then.

dboardfox: which part of the sky should you look at and at which direction are most meteors traveling?

*bill\_cooke*: You should look up. The meteors will be seen all over the sky.

zrestorick: Dr. Cooke, what is the most amazing celestial event you have personally witnessed or wish to see? Thank you. :)

*bill\_cooke*: The 2001 Leonids from Hawaii.

eferraiu: Is it possible to see the meteor shower from indoors if my lights are turned out and I have a clear view of the sky? My bed is right next to my window.

*bill\_cooke*: It is possible... though quite unlikely. Getting the most sky coverage is the best way to see meteors.

CloudsInCLE: About an hour ago, I saw several bursts of light in the northern sky behind cloud cover (looked like lightning), accompanied by a low rumble. No storms in the area. Assuming this is all part of the show?

*bill\_cooke*: Sounds like storm activity, not meteor activity.

sophgan05: In Victorville,CA We saw a huge fireball pacific time 9:00 pm

*bill\_cooke*: Fantastic! We love hearing good reports.

tr3: I'm planning a night hike 3am-6am PST in El Cajon, California, with a group of friends. About what percentage difference will tonight's show (10-11) be from tomorrow night's show (11-12) when it peaks? Is there really that much of a difference in how many meteors we might see?

*bill\_cooke*: Tonight you will see less than half of the rates of tomorrow night. Check out [imo.net](http://imo.net) for live ZHR rates.

prince40000: Are the showers visible only at 4 am or even around midnight?

*bill\_cooke*: You can start seeing Perseids after 10 p.m. We are recommending the hours before dawn, since rates will be best then.

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SailingMermaid: I know you mentioned the ISS before, what about the meteors impacting other objects in orbit such as GPS satellites?

*danielle\_moser:* Yes, there is a risk to spacecraft from meteoroids. At the Meteoroid Environment Office ([meo.nasa.gov](http://meo.nasa.gov)) we have models to try to predict that risk. The sporadic background meteoroids (not shower meteoroids) collectively represent the majority of the total risk during a spacecraft's lifetime. On a related note, Olympus, an ESA communications satellite, was struck by a Perseid near the time of the shower peak in August 1993. It sent the spacecraft tumbling. By the time control was restored the onboard fuel had been exhausted, and the mission had to be terminated.

StarGazer420: is there any equipment i can or should use to watch the shower (i.e. binoculars) or would the naked eye be best?

*danielle\_moser:* Naked eye is best!

njgmoorman: What is the highest ZHR ever recorded for any meteor event, not just perseids

*bill\_cooke:* In 1966, Leonids were the largest shower ever recorded with rates as high as 10,000 per hours.

NikiGa: How fast do the meteors travel?

*danielle\_moser:* Perseids travel 59 km/s or 132,000 mph. That's about 500 times faster than the 2011 Bugatti Veyron!

Dharvey3232: does the swift-tuttle always follow the same path around the sun?

*bill\_cooke:* Yes, though if the comet passes close to a planet, the planet's gravity can perturb the comet and change its orbit.

*moderator\_brooke:* We're starting to work through our queue, so if you have questions for our astronomers, now is your chance. Thanks for all the terrific participation!

stargazerr21: About how many meteors would an average person see tonight?

*danielle\_moser:* 30 per hour in the hours before dawn when the Perseid radiant is highest in the sky

prince40000: the fluximator suggests ill really only see most of the shower aroud 4am. can i hope to see a good shower at midnight today also?

*bill\_cooke:* No, while it is possible to see Perseids at midnight, you won't get a good show until the hours before dawn.

SomeKindOfNerd: Any sightings?

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*danielle\_moser*: Yep!

Kenzie\_21: Just curious, what is your job title? (probably a dumb question)

*bill\_cooke*: The lead of NASA's Meteoroid Environment Office.

David: If Swift-Tuttle passes by Earth every 133 years or so, and it's tail of debris is only so long, will there be years during which there will be NO Perseid meteor shower?

*danielle\_moser*: Not as far as we know.

Dharvey3232: we have sporadic cloud coverage but mostly clear where we are. we witnessed a large tail a few moments ago. is there a chance of a meteor creating a sonic boom?

*bill\_cooke*: Yes. The largest meteors will produce sonic booms. However, Perseids will not --- they do not get low enough.

mstwolf: Thank you guys for taking the time to answer such trivial questions. You guys are a wealth of knowledge.

*bill\_cooke*: We are so glad you are enjoying it!

Chax: What is the best location to look in the sky if you are in Wisconsin?

*danielle\_moser*: You don't need to look in any particular direction. Just get away from bright lights and look up!

CBM: When I look up and see a meteor in Ohio can someone in California see the same one??

*bill\_cooke*: No. Though a bright meteor can be seen up to 200 miles away, Ohio to California is a little too far away.

oak9898: is the very best time to see the shower tonight or tomorrow night

*danielle\_moser*: Perseids are expected to peak tomorrow night.

JonnyD: What can I expect to see through the Live Ustream View?

*danielle\_moser*: You should see bright points of light on a black background. These are stars. They twinkle. Meteors will appear as bright streaks of light that appear and disappear quickly.

wic: How dangerous are meteor showers to the ISS and other satellites?

*bill\_cooke*: Meteors are a concern of satellites and spacecraft, though meteor showers are only 10% of the risk. During meteor showers, the risk is higher, but the risk from background meteors is still

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collectively 90% of the total risk. The main products of the Meteoroid Environment Office are models that predict this risk. This helps engineers figure out how much protection to build onto their spacecraft.

TomCat: Does the dust from Swift Tuttle accumulate orbit to orbit or does it leave a different dust trail each time it orbits the sun?

*bill\_cooke*: There's a different dust trail each time it orbits the Sun.

CCRocks: Is there any possibility that one of these meteors from the Perseids could crash to earth? I say, no, but someone else in my house is saying they can.

*danielle\_moser*: Perseids burn up completely in the atmosphere.

zrestorick: It is incredibly generous of you all to spend your precious time to chat with us "lay people" and arm-chair astronomers when you obviously have more important things to do. What motivates you to do something like this web-chat that is so redundant and I'm sure, boring for you? Clearly we all appreciate it and are loving every minute, but why do you do it?

*bill\_cooke*: We enjoy what we get to do for a profession and are happy to share that with the public.

Kenzie\_21: if i go outside tonight around 3 or 4 AM could i see some meteors?

*danielle\_moser*: If you are north of 32 deg South latitude and you have clear dark skies, yes.

bitcrazy: Why sometimes, We are told to look in a certain direction for the meteor showers, But not this one. Thanks

*bill\_cooke*: For meteor showers, always look up. The radiant may be in different places in the sky, but the meteors from that radiant are seen all over the sky.

Afox: Will they be visible for Central States tonight?

*bill\_cooke*: Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

tank116: I have heard that the Earth will pass through ISON's tail is that true and will it produce the same type of showers?

*bill\_cooke*: If ISON survives its passage around the Sun, it will pass through the gas tail, but there will be no meteor shower.

spaceghost: I cannot even fathom a ZHR of 10,000! Is there any type of footage or photos from the 1966 Leonids? That is just mind-boggling!

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*danielle\_moser*: I know! I wish I could have seen it! Check out <http://leonid.arc.nasa.gov/1966.html> for eye witness accounts and photos.

*Constellar\_Sombrero*: Is there a chance we can see some of the persaid meteors tonight ? If so what would be a good time ?

*bill\_cooke*: Yes. Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

*Chax*: What was that meteor that went into russia a year or two ago that caused the damage to buildings? Or was that a comet?

*bill\_cooke*: In February, a large meteor exploded over Chelyabinsk, Russia, damaging many buildings.

*Dharvey3232*: has there ever been a meteorite that crashed into earth bearing a new element? something not found on the periodic table?

*bill\_cooke*: No.

*juk*: Have you guys thought about setting up a panoramic camera instead? and i'm guessing we're looking at the big and little dipper/ north star correct?

*bill\_cooke*: Panoramic cameras are not sensitive enough.

*CBM*: okay, so where is 32 deg south latitude???

*danielle\_moser*: In the southern hemisphere. ☺ Given clear weather and dark skies, the Perseid meteor shower can be seen by most of the world and is best viewed by observers in the Northern Hemisphere. Places where the Perseid radiant isn't visible include the southern parts of Australia, Africa, and South America, and all of Antarctica.

*nogud*: Do you work with Bill Nye?

*danielle\_moser*: Nope!

*thegentle*: on the Ustream view, how large of an area might a perseid take up? i'm thinking scale within screen.

*bill\_cooke*: A Perseid would be a streak that would extend across most of the field of view.

*kenny*: where i can see them? im from Honduras

*rhiannon\_blaauw*: You can see them by looking up! Get as far away from city lights as you can, let your eyes dark-adjust, and enjoy!

*Gemini83*: we could be showered with gas from ISON though right? Does this happen often? \*gas shower\* ?

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*bill\_cooke*: No, the gas of a comet's tail is much too diffuse; it's better than most vacuums that we can generate here on Earth.

Don\_le\_Doge: What would be a good time to see the persaid meteor shower tonight in the florida area ?

*bill\_cooke*: Tonight between 3 a.m. and dawn.

Dharvey3232: are the majority of commets, meteors ect. made up of ice and dust?

*rhiannon\_blaauw*: Yes. The meteors that come from comets are ice/dust, and the meteors that come from asteroids are more rocky and more dense than the meteors that come from comets. Hence most meteors that survive their passage and make it onto Earth's surface to become meteorites, are from asteroidal origin, not cometary.

nogud: Are meteorites made mostly of iron or is it compacted dust and rock?

*bill\_cooke*: Most meteorites are common chondrites which are made of rock, usually with a bit of iron and nickel thrown in.

kenny: oo thanks but i have 13 years old and i am on the city and i cant go to another place. i can see some of them?

*rhiannon\_blaauw*: Hopefully we will see meteors in our live-feed! It is on-and-off cloudy here in Huntsville, Alabama, and quite hazy, so conditions aren't ideal... but we could still see some meteors!

highrise: when would be the best time to view from Texas?

*rhiannon\_blaauw*: The best time would be in the hours before dawn on August 12th (Monday morning). From about 3-5am local time. However you can see Perseids anytime after 10 pm local time for the next several nights.

CloudsInCLE: Thanks for sharing your knowledge with us...

*bill\_cooke*: You're very welcome!

sunny: Why do the stars appear and disappear on the screen in the live stream?

*rhiannon\_blaauw*: The stars are flickering due to the atmosphere, there is also a lot of haze and some passing clouds here.

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Mile\_High\_Baby: I just want to say that the questions and answers are absolutely fascinating and want to thank the astronomers for all the valuable information!!

*bill\_cooke*: You are very welcome!

Madi\_Zie: if its cloudy can you still see some meteors?

*bill\_cooke*: No. Have to have clear skies.

Tyler: What is a good time to see the shower in New Hampshire tonight, and tomorrow?

*rhiannon\_blaauw*: The best time would be the hours before dawn - 3 a.m. til 5 a.m. local time.

Madi\_Zie: when will the next big meteor shower be?

*bill\_cooke*: Geminids in mid-December.

XxSpinexX: Where is the feed from?

*rhiannon\_blaauw*: From a wide-field meteor camera located here at Marshall Space Flight Center.

Gemini83: what was ZHR of 2001 Leonid shower??? I estimated that I saw about 2500 or so per hour for a few hours straight, how many did you see that night Bill?

*bill\_cooke*: About 2000 per hour. Very spectacular.

Jer: Is there any chance at all that one of the metors would hit earth

*rhiannon\_blaauw*: Not Perseids. They burn up by 55 miles above Earth's surface. However meteors survive passage to land on Earth's surface and become meteorites on a daily basis.

Jer: Thanks to Nasa and ustream, very cool. I live in a City and very hard to see

*rhiannon\_blaauw*: Glad you enjoy it! We are happy to do it.

Chax: we have northern lights sometimes early in the AM, will that impact my view of the meteors?

*bill\_cooke*: No.

Madi\_Zie: How often do you do these chats? :)

*bill\_cooke*: During the Perseids and Geminids meteor showers.

otto: if all the meteors originate from the single source of one comet, why do they appear to travel from all directions?

*danielle\_moser*: Tonight you will see shower meteors, like the Perseids and the Capricornids. Perseids all appear to come from the same point in the sky called the radiant. The Perseid radiant is located in

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the constellation Perseus. All meteoroids associated with one particular shower have similar orbits, and they all appear to come from the same radiant. The shower meteoroids enter Earth's atmosphere along parallel paths. But perspective makes shower meteors appear to come from a single point in the sky, just like parallel railroad tracks appear to diverge from a point on the horizon. Perseids can appear all over the sky. Besides the Perseids, you'll also see sporadic meteors. These you will see traveling in all different directions. They don't have the same radiant.

TomCat: Q: Why was the Perseid Meteor arrested? A: For "Streaking" across the sky.

*rhiannon\_blaauw*: Haha. We appreciate that.

David: Have you had a chance to identify the stars in the video stream yet?

*danielle\_moser*: No, sorry.

sillywoman: Are there any interesting historical or mythological stories linked to the perseids?

*bill\_cooke*: Much mythology concerning Perseus, the constellation. As far as the Perseids, they are also called the Tears of St. Laurence because they occur near the feast day of that saint.

Gemini83: do we expect a meteor shower from Comet ISON in 2014? if so when?

*bill\_cooke*: No. Earth is too far away.

mstwolf: What kind of programs do you use to filter sound?

*danielle\_moser*: I'm not sure what you mean?

mbiker27: whats the really slow moving object near the left side, mid way up the screen? It intersected with a star a moment ago

*danielle\_moser*: I didn't see it, but it may have been a satellite.

Gemini83: spectacular indeed, Leonids 2001 was most amazing thing I have witnessed in 30 years on this planet. Do you think we will see something like that again in next 20-30 yrs? Any estimate on when? I know about possible storm May 24, 2014 but any other chances?

*bill\_cooke*: Perseid outburst in 2016.

Echo: Manitoba Canada reporting in, cloudy here so thank you so much for sharing.

*danielle\_moser*: Thanks for joining us!

XxSpinexX: How many years has this shower of debris been creating this light show? How many years will it continue for?

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*bill\_cooke*: It was seen by the Chinese 2000 years ago and we anticipate it going on for the foreseeable future.

*moderator\_brooke*: We're hearing a lot of great reports from everyone about Perseid viewings all over the world. Thanks for sharing those, and thanks for your questions. We appreciate you being here tonight and making this a great success!

*njgmoorman*: When is ISS going to pass over Cincinnati, Ohio next?

*rhiannon\_blaauw*: [www.heavens-above.com](http://www.heavens-above.com) is a great site to use to see when the ISS is visible from your location.

*rlbevins*: Will we be seeing Slooh space camera footage tonight?

*danielle\_moser*: Not on our chat page, no. You'll have to check their webpage to see if they're doing anything special for the Perseids. <http://events.slooh.com/>

*Mile\_High\_Baby*: How long with y'all be on here answering questions?

*rhiannon\_blaauw*: Til 2 a.m. central time.

*mymonka*: What is the difference between a storm and an outburst?

*rhiannon\_blaauw*: An outburst is more-than-normal rate, a storm is 1,000+ an hour.

*Gemini83*: Thanks Bill, gotta ask, where will you be in August of 2016? do you have a favorite spot to watch outbursts/storms??

*bill\_cooke*: Probably right here in Huntsville.

*JDAVIES*: Hey, NASA! Can I have a job?

*danielle\_moser*: Check out [www.usajobs.gov](http://www.usajobs.gov) for job openings at NASA.

*David*: Will the orbit of Swift-Tuttle ever change drastically enough that the Perseids will no longer be called the Perseids (will they have a new radiant)?

*rhiannon\_blaauw*: Based on current calculations, the orbit should be relatively stable for the next few centuries.

*Demasu*: I really wish I wasn't in the horribly light polluted Houston. Even with the cloud coverage I would still be able to see some if it wasn't so bright. Didn't get a chance to go to the George Observatory either

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*rhiannon\_blaauw*: Hopefully it will be clear for you tomorrow night, or the next!

*brey*: Is there any specific spots I should be watching?!

*bill\_cooke*: Lie on your back and look straight up. Let your eyes adjust to the dark, which can take up to 45 minutes. And enjoy!

*Reece*: So, how are the Perseid Showers compared to the past few years?

*danielle\_moser*: The Perseids are fairly consistent year-to-year.

*dug44*: Just got here, has there been many on the live view?

*rhiannon\_blaauw*: We have seen several meteors on the Ustream, though haze and passing clouds have made it so that we have less than we hoped!

*Madi\_Zie*: what would be a good time to view the perseids tonight?

*bill\_cooke*: Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

*Draevan*: Been watching the live feed for the past couple of hours..It appears that new starts are popping up in the feed. Is that due to clouds or other factors lessening as it gets later in the night?

*bill\_cooke*: As the night wears on, new stars move into the field of view due to the Earth's rotation.

*argallel*: Why do meteors come by on a regular schedule? Thanks for all your hard work tonight!

*rhiannon\_blaauw*: Meteor showers occur on a yearly basis (the Perseids occur every August, the Geminids occur every December, etc) because that is when Earth is passing through the stream of debris left by the parent bodies. The parent body of the Perseids is comet Swift-Tuttle. When Earth passing through the stream of debris left by Swift-Tuttle, we see Perseids. That happens yearly as earth passes around the sun yearly.

*Demasu*: Do you all use any specific place/site/resource to get a clear sky chart? Is there a good website or app I should get to get that information?

*bill\_cooke*: I use planetarium programs on my iPad.

*Mile\_High\_Baby*: Given that we are watching live feed from Huntsville, AL (I'm assuming), when can we anticipate seeing the most activity via the live feed?

*bill\_cooke*: Between 3 a.m. and dawn.

*David*: Did any ancient cultures consider the Perseid meteor shower particularly auspicious? Did it inspire any great works of art, or did it coincidentally mark any significant moments in history?

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*bill\_cooke*: Not as far as I know.

nogud: I am going to log off chat but wanted to say thank you to the Moderators for taking the time to do this.

*bill\_cooke*: You're welcome!

Dharvey3232: is there a live stream from one of NASA's orbiting satellites? and would they be in any danger from the debris?

*rhiannon\_blaauw*: No live-stream from satellites that we know of. There is some danger to satellites and spacecraft from meteors, though not significant. The risk from background meteors is 90% of the total risk, with meteor showers being the other 10%. So the risk is only slightly higher during meteor showers.

pokermama: i just saw 1 from my deck..so maybe they are starting now

*rhiannon\_blaauw*: Fantastic!

nogud: "*bill\_cooke*: I use planetarium programs on my iPad." Which ones?

*bill\_cooke*: Luminos, Sky Safari Pro, Distant Suns and Star Walk.

persiods: Could mars have visible meteors or does it totally have a lack of any resistance and zero atmosphere since the lost civilization destroyed its atmosphere?

*danielle\_moser*: Meteors could theoretically be seen in the Martian atmosphere. In 2005, a dedicated meteor observing campaign was carried out by the Panoramic Camera (Pancam) onboard the Mars Exploration Rover (MER) Spirit. Unfortunately, there were no conclusive meteor detections.

njgmoorman: so, will perseid continue until the whole comet has disintegrated?

*rhiannon\_blaauw*: The Perseids will continue unless the orbit of the stream gets perturbed by a close-encounter with a planet. This will not happen in the foreseeable future.

mstwolf: Which satellites are used for meteor observations and do you think Kepler is repairable?

*bill\_cooke*: No satellites are currently used for meteor observations. And as for Kepler, NASA is trying to fix it, but you really need to talk to someone who is associated with that spacecraft.

tom21: Yes, I'll echo that - thanks for this. Was just out testing the skies, and saw a nice bright one with a nice trail, directly overhead, from Bucks County, PA. Heading out for some more fun!

*rhiannon\_blaauw*: Awesome! So great to hear that.

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LTB: Is there any chance of catching a glimpse if u live in LA?

*danielle\_moser*: With light pollution from LA you'll be able to see the brighter Perseids, but you'll miss the faint ones.

tod: can you see it in vancouver

*bill\_cooke*: You can see Perseids from anywhere in North America, including Vancouver and New York.

MajentheGreat: Bright and beautiful ones coming in from Uintah County, Utah!! So exciting

*bill\_cooke*: Fantastic!

Joellyn: Pretty hazy and light polluted here in Columbus OH, but I still spotted 2 bright ones while walking the dog.

*bill\_cooke*: Great!

affan\_s: Cheers from Toronto. Its 1:30 AM EST. How do you like your coffee?

*rhiannon\_blaauw*: Just cream, please! Though if I'm at Timmies I may indulge and get a double-double. Greetings from a fellow Canadian. ☺

todd: Hello from New Zealand. When would I be ablt to see it?

*danielle\_moser*: Unfortunately New Zealand is too far south to see Perseids. ☹

Madi\_Zie: would it be possible for someone to get footage og the meteor shower? I was thinking of filming parts of it.

*bill\_cooke*: If you have a low light level camera, but those are usually low resolution and black and white (like the one on the live stream).

mhhhm: I wonder what would have happend if that one over russi hit the ground..

*danielle\_moser*: It would have caused even more damage.

Isotoleal: is it safe to say if we don't see any on the live feed that if I go outside there won't be any either?

*bill\_cooke*: No, because the live feed only shows a small segment of the sky. If you go outside, you can take in almost the whole thing, which greatly enhances your chances of seeing a meteor.

sammus: im in the center of houston texas if i go outside can i see them, its dangerous here, lots of crime i dont nomally go outside at night.

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*bill\_cooke*: Wouldn't recommend going out in the middle of a big city like Houston --- too many lights.

Derrick: Saw a couple from the top of the university parking lot at USF, Tampa

*bill\_cooke*: Great!

Gemini83: cloudy skies in southern colorado.....supposed to clear up a bit tho in the next few hours, how are rates so far?

*danielle\_moser*: Rates are low right now. They should increase as the night goes on.

Joellyn: Do different showers have different colors? I always see more green in the Perseids, but the Geminids (my fave) have more blue-whites.

*bill\_cooke*: People report colors to meteors; a lot of it depends on the person. Some people would say a meteor is white, but others may call it blue. Meteor colors are very subjective.

cadidaddy: so is tonight the night to be outside or tomorrow night

*bill\_cooke*: Tomorrow night.

AragonRed: Thank you Moderator Brooke, Bill and supporting team...it was very interesting. Have a good night.

*danielle\_moser*: Thanks for joining us! Clear Skies!

marya: we are out by yosemite in California. what direction should we look?

*bill\_cooke*: Lie on your back, look straight up and give your eyes time to adjust to the darkness.

Dharvey3232: is there any chance of something other than ice and dust in swift-tuttles tail?

*bill\_cooke*: Not much.

Corey\_W: does perseids bring the type of meteor that can cause a sonic boom?

*rhiannon\_blaauw*: No, Perseids do not get low enough to cause a sonic boom.

marya: thank you *bill\_cooke*!

*bill\_cooke*: You're welcome!

Gee.K: Ive never gotten the opportunity to see a meteor shower... I even drover out to the middle of nowhere one night for a shower last october.. stares at the sky for an hour and saw nothing... :(

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*rhiannon\_blaauw*: So sorry! The Orionids in October have much lower rates than the Perseids. Your best luck would be to go out from 3 am til 5 am local time on Monday morning (the 12th). Hope you see some!

David: Are meteor storms/outbursts predictable, or are they only classified as such after the fact? In short: is it possible to be surprised by a meteor shower these days?

*rhiannon\_blaauw*: It is absolutely possible, though we are able to predict most outbursts these days to fairly good temporal accuracy.

JJ: Compared to a everyday object, how small are these meteors tonight?

*danielle\_moser*: Meteoroids are quite small. Think sand grains and pebbles. Meteors, the streak of light created when the meteoroid ablates in the atmosphere, can be kilometers in length.

Mark: any advice for seeing earth grazers (like in 1998) --- are they viewable in all meeteor showers if you look early in the night?

*bill\_cooke*: If you see Perseid earth-grazers, they will occur around 10 p.m. at night. But the odds are small.

Stella: Almost out of beer, so I'll be turning in soon...thanks for a fun and informative night!

*bill\_cooke*: Sleep well.

Gemini83: Jupiter will be the cause of a possible outburst in 2016 right? why is this?

*rhiannon\_blaauw*: Yes, the Perseids can be gravitationally focused by Jupiter, so we will essentially be passing through a more dense clump of debris in 2016 compared to this year.

David: Any notable comet flybys coming in the next few years or so?

*bill\_cooke*: ISON. If it survives it

Gemini83: wow thanks for that Rhiannon ...another question, when do we know how dense the debris field is? I mean how far ahead of time can we see in our current orbital path?

*rhiannon\_blaauw*: We can predict these things decades in advance, because the motion of the planets as well as the stream is so well known (we will know when the stream of debris will be coming close to Jupiter, Saturn, etc).

Pebblesj: Just joined the chat. Hello to all from Dallas, TX!

*rhiannon\_blaauw*: Welcome!

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bob12: The International Meteor Organization (IMO) graph ([www.imo.net](http://www.imo.net)) shows a current rate of 39 meteors per hour, and rising!

*rhiannon\_blaauw*: Fantastic!

highrise: nice tunes NASA! :)

*rhiannon\_blaauw*: Thanks! That is 3rd Rock Radio you are listening to.

CBM: When does Haley's Comet return? Sometime around 2061 I think if memory and math haven't failed me.

*rhiannon\_blaauw*: You are correct. 2061. Got a ways to go still. ☺

DanBledsoe: Curious though. It seems like the notice of the showers was last-minute as far as meteor showers go. How come?

*danielle\_moser*: The Perseids happen every year. We've got lots of notice for them. :-) Occasionally we will get new showers predicted, either because of new comets or new analyses of older comets. So there is less notice for those.

Tyler: Have any meteors been spotted on the camera below?

*danielle\_moser*: Yep!

Chax: Is there a particular night that will be best?

*danielle\_moser*: The Perseids peak Aug 11-12. So that's tomorrow night.

MajentheGreat: Will we see a quite a few tonight?

*danielle\_moser*: Tonight we'll probably see as many as 30 Perseids per hour (with a dark sky & good weather) closer to dawn.

1derwoman: Hello! I'm in far northern IL - just took my kids out to see the "shooting stars" but we didn't see anything... are we in a good place to be able to see them?

*rhiannon\_blaauw*: Yes, you can see them, though the rates are not very high yet. If you wait until the hours before dawn you will see about 30 per hour (if you are in a clear/dark areas), however wait one more day until the early morning of August 12th and you may see between 60 and 100 per hour.

mstwolf: Seeing as no satellites are used for watching meteors, how do u guys keep tabs on what could be coming our way? What kind of equipment do you use? I have so many questions and seemingly running out of time lol

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*bill\_cooke*: Radar and optical cameras.

CloudsInCLE: What are the chances of one of these making it all the way to earth and causing problems?

*danielle\_moser*: Perseids ablate completely in the atmosphere, 80-90 km up. They don't make it to the ground.

Pebblesj: Probably a stupid question but.....how long do comets last?

*rhiannon\_blaauw*: Highly dependent on both the size of the comet, the composition, and how often it travels around the Sun. A small comet can last 70-100 revolutions around the sun.

Dharvey3232: if this shower is averaged at 100 per hour is there a way to know wiath it will average next year or in 2016 when it's supposed to be more dense?

*bill\_cooke*: Haven't looked into that in detail. Still three years to go. Ask me in 2015.

andrew: is there a lot of debris near the ISS?

*bill\_cooke*: No.

Dharvey3232: yes thank you so much for sharing your knowledge. we are all a bit more intellegent lol

*danielle\_moser*: You are welcome!!!

Indiana\_Pete: I assume that there is a directionality from North to South in the path of the Shower?

*rhiannon\_blaauw*: Yes. The meteors will all be pointed away from the radiant, which is in Perseus (in the North, North/East), however they are seen all over the sky.

RickToTheMax: Are meteroid showers less and less intense every year as the earth cross the path of the comet debris? are the debris moving?

*bill\_cooke*: No, because the comet continuously leaves new debris every time it swings around the Sun. And, yes, the debris orbits the Sun just like everything else in the solar system.

CBM: Well thank you so much MEO crew! I have enjoyed this informative chat very much but since it is cloudy in Cincinnati and 2a.m. it's time for some shut. Hopin' for a cloudless sky tomorrow's peak night

*bill\_cooke*: You're very welcome!

w5wpl: Will the Perseids ever be as grand as it was in 1967?

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*bill\_cooke*: 1993 was better than 1967.

Kenny: This is really, really cool. Thank you for doing this.

*bill\_cooke*: You're welcome.

XxSpinexX: So, the Earth is travelling through the debris field of a live comet that comes by every couple hundred years..... Given a long enough time line... We ever going to meet up with this comet?

*rhiannon\_blaauw*: In 2126 it will be close enough to Earth to likely be seen with telescopes. Comet Swift-Tuttle has a period of 133 years.

David: Do you have any meteor shower traditions (food, clothing, location)?

*bill\_cooke*: Krystal burgers.

FM\_Bob: From what I have read online, one is to look to the northeast sky? Low or high?

*rhiannon\_blaauw*: Just lie on your back and look straight up. Let your eyes dark-adjust which can take up to 45 minutes. The meteors will be seen all over the sky.

Tammi: why will there be so many before dawn but so few now?

*danielle\_moser*: Perseid meteors have similar orbits and all appear to come from the same point in the sky called the radiant. The Perseid radiant is in the constellation Perseus. As the night goes on, the Perseid radiant climbs higher and higher in the sky, being the highest in the hours before dawn. You see more Perseids when the radiant is high in the sky.

Pebblesj: This fascinates me. I had a customer yesterday explaining to me about meteors and meteorites. I think I have found a new "hobby"!

*rhiannon\_blaauw*: Fantastic! We are glad to hear that.

affan\_s: I realize the ISS is protected and armoured, but exactly how does it do it? I don't think it has steel plates around it. Also how does it protect its solar panels?

*bill\_cooke*: It has layers of aluminum plates with kevlar/nextel stuffed between them. Solar arrays have no shielding and gradually degrade with time.

pewppile: if a meteor land son my camry can i turn it into the sword of excaliber

*danielle\_moser*: That sounds like a video game idea. 😊

Gemini83: Do we also measure the amount of debris left by comet on each pass ??? How much does that vary?

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*rhiannon\_blaauw*: How much dust a comet leaves can be measured. It varies based on the composition of the comet, the size of the comet, and how close to the Sun it passes. It varies a lot.

w5wpl: We saw some big ones in 1967 in San Diego

*danielle\_moser*: I'm jealous! 😊

chrisy: Thanks for answering our questions, I've learned quite a bit tonight! Happened to see 2-3 up here in Toronto around 12-1am. Hopefully watching tomorrow late at night will pay off. Good night from Canada!

*rhiannon\_blaauw*: Goodnight! (From another Canadian 😊 ) Glad you saw a couple meteors!

mstwolf: I've seen a few questions on the comet ISON and the answer usually comes w/ a "If it survives." Is this because the comet will be passing so close to the sun that the sun will kill it?

*bill\_cooke*: Yes. The comet will pass extremely close to the Sun --- less than a million miles. It is highly unlikely that ISON will be able to avoid disintegration at that close distance.

God: For Southern California residents, what's the best time tomorrow to see the shower?

*bill\_cooke*: Between 3 a.m. and dawn.

Treads: I saw a white bright thing going straight down and not at an angle. Now can these fireballs cause a fire in the country where the timber is dry and a county under a burn ban,

*bill\_cooke*: Perseids never make it to the ground. Even if a meteorite was produced, by the time it reaches ground, it is fairly cool. The notion that meteorites are steaming hot rocks is a myth propagated by science fiction shows and movies.

topgunphantom: has the majority of the meteor shower finished?

*bill\_cooke*: No, it peaks tomorrow night.

MountainMike: Is that typical for the rest of the US? I am in Michigan.

*bill\_cooke*: Yes.

Treads: Can these meteors causer a forest fire if the timber is dry.

*bill\_cooke*: No, they never make it to the ground.

Draevan: Not a question. Just wanted to give y'all a thumbs up on the music being played. Totally relaxing to "Mad World" right now. Perfect song for watching the sky

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*rhiannon\_blaauw*: Glad you are enjoying it! NASA's 3rd Rock Radio.

trichards: will the showwer be able tobe seen in oklahoma? i have a son whohas stayed upallnight towath it.

*bill\_cooke*: Tomorrow night is the best night, after 10 p.m. The best time is between 3 a.m. and dawn. Lie down on your back and look straight up, allowing time for your eyes to adjust to the dark.

MountainMike: Thanks to the experts for spending time with us. Will NASA host events like this for future meteor showers?

*bill\_cooke*: You are welcome. Yes, we will be here for the Geminids in mid-December.

w5wpl: Is this from Haley> If not what comet?

*bill\_cooke*: Comet Swift-Tuttle

jskauai: are planes or satelites ever in danger of these showers?

*rhiannon\_blaauw*: There is always a danger to spacecraft from meteors. During meteor showers the risk is higher, but the risk from background meteors is still collectively 90% of the total risk (the meteor showers being the other 10%).

mstwolf: What would your advice be for someone to become an astronomer?

*bill\_cooke*: Lots of math and physics and boundless enthusiasm!

Pebblesj: Was that a meteor that hit in Russia several years ago?

*rhiannon\_blaauw*: In February a meteor exploded over Chelyabinsk, Russia. It was a very rare and large event - very interesting to study!!

tonromeo: Just saw three shoot across the shy here in Atlanta

*rhiannon\_blaauw*: Fantastic!

godsown: Is the debris (meteorites) possibly from Nuburu, the newly discovered Planet X? Or is 'Nubaru' a false claim altogether?

*bill\_cooke*: That's a hoax.

Treads: Are you on the space station or on earth

*rhiannon\_blaauw*: We are located at Marshall Space Flight Center in Huntsville, Alabama.

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spaceghost: How will all of the staff at MEO be watching the shower tomorrow night? I see Krysal burgers are a tradition. Will you be watching from outside, or do you have other tasks that will have to be done?

*bill\_cooke:* I will let my cameras do the watching. They do not tire, need coffee or have to go to the bathroom.

w5wpl: Is there a shower related to Haley? Haley was a big disappointment in 86

*bill\_cooke:* There are two meteor showers caused by Comet Halley, the Eta Aquarids in May and the

RickToTheMax: Can the people onboard the ISS see the meteor shower, if so do they have a better show than we have here on the ground?

*bill\_cooke:* If they look down. As far as a better show, I have no way of knowing, having never been up there.

COSDAVE: If ISON disintegrates which is a highly controversial prediction, will it still create a meteor shower in January 2014 as was predicted?

*rhiannon\_blaauw:* ISON will not cause a meteor shower. We may receive particles from ISON but they will be too small to cause a meteor shower.

Tulsa: Unfortunately Eastern Oklahoma is forecast to have nearly 50% sky cover tomorrow night but will see what is visible from the lake. Very informative chat. Thanks for the info!

*bill\_cooke:* You are welcome!

jskauai: how well we see this shower in kauai hawaii we have a view from barking sands missile base i believe nasa has a viewing station there

*bill\_cooke:* Tomorrow night, if it's clear, you should have a good show.

topgunphantom: where is the best hemisphere to see the shower?

*rhiannon\_blaauw:* Northern. You can still see the meteors in the Southern hemisphere - though not the Antarctic, southern parts of South America, and southern parts of Australia.

godsown: Thank you vey much!

*bill\_cooke:* You are very welcome!

Joellyn: Do they have completely different showers in the Southern Hemisphere?

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*bill\_cooke:* There are some meteor showers that are best seen from the Southern Hemisphere, like the Monocerotids and the Gamma Normids.

annabelle: When is the best time for us Kentuckians to see it

*bill\_cooke:* Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time. The peak is tomorrow night.

Matt Edmonton: Is there a certain time in Western Canada that we will be able to see the most at one time tonight? When is the peak?

*rhiannon\_blaauw:* The peak time is early-morning on August 12th (Monday morning). 3 a.m. to 5 a.m. Though tomorrow morning the rates will also be high.

annabelle: thank you so much for the info..sure will watch it tomorrow

*bill\_cooke:* You are very welcome!

uchoax: hey, when is it in GMT time?

*rhiannon\_blaauw:* The times we give in these questions are local time.

carlos: Will the meteors be more visible at 1 mile altitude in Denver, Co?

*bill\_cooke:* No, one mile doesn't make much difference.

patricia\_hernandez: What is the best time for phoenix, Az to watch

*bill\_cooke:* Between 3 a.m. and dawn. Tomorrow is the peak.

tt: When would be the best time for chicagoans to see them?

*bill\_cooke:* Between 3 a.m. and dawn. Tomorrow is the peak.

topgunphantom: how visible are the meteors in washington dc?

*rhiannon\_blaauw:* Best to get as far away from city lights as possible. And go out between 3 a.m. and 5 a.m. on Monday morning the 12th. That's your best bet. ☺

Matt Edmonton: Will the peak take place between 3 - 5 am in Edmonton Alberta Canada?

*bill\_cooke:* Between 3 a.m. and dawn. Tomorrow is the peak.

uchoax: ok, but local time from where? I'm from Brazil, GMT-3

*rhiannon\_blaauw:* Local time is the time wherever you are. 3-5 a.m. is the peak, wherever you are.

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Matt Edmonton: Thank you VERY VERY MUCH BILL

*bill\_cooke*: You are very welcome!

star64z3r: so, I just went out to what I thought was a pretty dark place with only a couple of street lights in the area, and stayed out for about an hour before a cloud cover started moving in, and only saw 2 maybe 3 meteor's. Should I have been able to see more in an hour ?

*bill\_cooke*: You did well, given the lights and the sky conditions. Tomorrow the rates will be better.

topgunphantom: thank you so much

*rhiannon\_blaauw*: You are very welcome!

uchoax: ah, thank u very much!

*bill\_cooke*: You are very welcome.

Clone2261: Will meteors be visable for Texas? Not very sure yet.

*rhiannon\_blaauw*: If your skies are clear - yes! Best rates will be August 11/12 and 12/13th, in the hours before dawn.

*moderator\_brooke*: Hi everyone -- we have about 30 minutes to go in the chat so if you have questions for our team, now is a great time to ask!

Madi\_Zie: Reporting in from Illinois : clear skies and have seen quite a few meteores!

*rhiannon\_blaauw*: Fantastic! Glad to hear good reports.

rbg: Out in Iowa, near the quad cities. Skies are a little hazy, but clear. Saw somewhere near 1 meteor every 2-3 minutes. Some quite prominent.

*bill\_cooke*: Great!

topgunphantom: do meteor showers happen every year?

*danielle\_moser*: There are many meteor showers that are active every year, like the Perseids and the Geminids. Some show much more variability in their rates from year to year, like the Leonids. And some are only rarely active, like the Aurigids and the June Bootids.

spaceghost: I would like to Thank Bill, Danielle, Rhiannon, Brooke, and Janet! I really learned a lot tonight. I have always been a fan of NASA!! I look forward to the next chat in December! Good night!

*rhiannon\_blaauw*: You are so welcome! Thanks for joining us. ☺

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bob12: danielle: Me too in Manitoba. Mostly Cloudy. Hope it passes!

*danielle\_moser*: Clouds are the worst. Wishing clear skies your way!

mstwolf: Thank you so much for your time. It was very informative and I will continue on my quest to become an astronomer one day, but for now I bid you good night from Virginia and look forward to chatting come the Geminids =)

*rhiannon\_blaauw*: Thanks for tuning in!

toby: chatting again tomorrow or monday evening?

*rhiannon\_blaauw*: No - just chatting tonight.

Gemini83: is there a program that illustrates the density of these debris fields and our orbit? What kind of data does NASA rely on to anticipate how thick a debris field is, what part we will go through, etc?

*rhiannon\_blaauw*: Complex models based on past data and gravitational perturbations from planets.

Zizabella: I am trying to find out when the best time to view the Perseids is here in Boynton Beach Florida zip code 33435

*bill\_cooke*: Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time.

Mile\_High\_Baby: To view the Perseids meteor shower each year, will the dates and hours be close to the same every year in August?

*bill\_cooke*: Usually around August 12th. It gradually changes over time.

star64z3r: What would you say is the best and brightest and brightest meteor shower to see with the naked eye in North America ?

*bill\_cooke*: I am fond of the Perseids, but some are fond of the Geminids.

toby: thanks for the chat! feed view from northern AL looks great (and is saving me from mosquitos :)

*bill\_cooke*: You are welcome.

Zizabella: This morning, Monday morning? I have read conflicting new reports

*bill\_cooke*: The peak is Monday morning before dawn.

David: What's the most underrated astronomical phenomenon? It sounds like the setup to a joke, but I'm genuinely curious.

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*danielle\_moser*: This has actually stirred up a discussion here. 😊 Bill says conjunctions.

*Lookin4meteorites*: I'm watching the live broadcast. There's an object moving slowly in the upper left quadrant of the view. At first I thought it might be twin stars, but one is definitely moving. Wonder what it is?

*bill\_cooke*: A satellite, probably.

*Gemini83*: Does Nasa publish this data (perturbations, density,etc) anywhere that I can view it?

*bill\_cooke*: No. You can get some information by going to [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov)

*tt*: when is the best time to see the medeoroids on the webcast?

*rhiannon\_blaauw*: Early-morning!

*affan\_s*: Thank you all. You are wonderful people. Goodnight from Toronto.

*bill\_cooke*: You are very welcome.

*topgunphantom*: can comets appear in meteor showers?

*rhiannon\_blaauw*: Meteor showers are caused when Earth passes through the stream of debris left by a comet.

*njgmoorman*: does Haley's comet produce a meteor shower?

*rhiannon\_blaauw*: Yes - two, in fact. The Eta Aquariids and the Orionids.

*RileyBlackwolf*: Are there any comets coming through our solar system anytime soon for our viewing pleasure?

*rhiannon\_blaauw*: Comet ISON, if it survives its passage around the Sun, will be a nice comet to observe.

*tt*: will it show as a line across the webcam?

*rhiannon\_blaauw*: Yes, a streak.

*SummEAR*: Hi I am 9 years old. how many per hour in MO.

*bill\_cooke*: Tomorrow before dawn, between 60 and 100 per hour.

*RileyBlackwolf*: What hours are "pre-dawn" exactly?

*rhiannon\_blaauw*: 3 .am. til 5 .am., local time.

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Gemini83: when does NASA expect a larger debris field for Geminids? they seem to be most consistent shower, weather and moon permitting of course.

*rhiannon\_blaauw*: Geminids have no predicted outbursts in the foreseeable future.

topgunphantom: are any planets coming through our solar system to see?

*rhiannon\_blaauw*: You can see several planets right now - Jupiter and Mars in the morning (in the east) and Saturn and Venus in the evening (in the west)

vohpoh: Thanks for answering my questions

*rhiannon\_blaauw*: You are so welcome!

PoeticJustice: Did I miss the shower?

*bill\_cooke*: No. Any time after 10 p.m. local time. Best would be between 3 a.m. and 5 a.m. local time. Tomorrow night is the peak.

RileyBlackwolf: When will Comet ISON arrive? All I can find is that it will pass closely to the sun in November?

*rhiannon\_blaauw*: [science.nasa.gov/science-news/science-at-nasa/2013/18jan\\_cometison/](http://science.nasa.gov/science-news/science-at-nasa/2013/18jan_cometison/)

Gemini83: also how can I find out what area of Earth is facing debris field during upcoming meteor showers peak hours?? I know its not exact as usually its give or take a few hours but it seems like this information isn't readily available in the last few years

*bill\_cooke*: Most meteor showers last a couple of days or more, so it really doesn't matter longitude-wise where you are. Your location is really only important during short-lived meteor outbursts or storms, which are rare.

topgunphantom: will this shower occur on the same date in 2014?

*bill\_cooke*: Yes, it will be around August 12th.

hbhb: what about bogota, colombia.what would be the peak

*bill\_cooke*: The peak is tomorrow night just before dawn.

*moderator\_brooke*: We have about 10 more minutes in our chat, so if you have questions, now is the time to ask!

helencate: where do i point my eyes in sky?

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*bill\_cooke*: Lie on your back and look straight up. Let your eyes adjust to the dark, which can take up to 45 minutes. And enjoy!

*weaver*: Tried to watch them at various locations tonight. Too much light pollution. Kind of bummed, used watch them in my backyard every year. Here in Riverhead, NY. The clouds aren't helping either.

*rhiannon\_blaauw*: Maybe try tomorrow nights? Rates should be much better. Especially in the early morning hours (3-5 a.m. local time). Hope you see lots!

*Gemini83*: Thank you, the information you provide is excellent Bill. As it pertains to May 24th new shower, predictions seem to vary wildly from 100 per hour to maybe 1000? Will this prediction become more refined as we get closer to debris field?

*bill\_cooke*: No, that prediction can only be improved by more simulations, as we cannot see the debris fields. Observations are not helpful here.

*Warpfactor*: Would I be correct in saying the Geminids have a high per hour meteor count but the Perseids have a better chance at producing fireballs?

*rhiannon\_blaauw*: No. You would be correct in saying that Geminids have a higher meteor rate, but the Perseid shower lasts longer which means it has more bright meteors.

*toby*: A great benefit of chronic insomnia--reading this chat & running outside to watch the shower. thanks, again, y'all!

*bill\_cooke*: You are welcome!

*Boiler21*: Hi, Will this event be viewable from Houston? If so, what time/date?

*rhiannon\_blaauw*: Yes! You can see meteors after 10 p.m., though best rates will be between 3 a.m. and 5 a.m. local time. Particularly on August 11/12 and 12/13.

*topgunphantom*: are any constellations visible in the meteor showers?

*bill\_cooke*: Constellations are made up of stars and so are many light-years away from Earth. They have nothing to do with meteor showers.

*Brackin*: I saw one that left a trail of what I guess was smoke- not fireball close. What size of rock does it take to get that effect please

*rhiannon\_blaauw*: Inch-size.

*tdo*: any tips for someone in Australia who wants to watch the shower ?

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*bill\_cooke*: Go north.

David: Thanks for taking the time to answer our questions! I'm gonna go study up on conjunctions . . . and also where I can find Krystal burgers in Los Angeles.

*danielle\_moser*: Lol. Thanks for joining us and have a great night!

*moderator\_brooke*: We have time for a couple more questions...

topgunphantom: what is the lifespan of a meteor?

*rhiannon\_blaauw*: A meteor only lasts seconds. A meteoroid (the particle that causes a meteor) may be thousands or millions of years old.

Gemini83: hmm interesting, so we never actually "see" these debris fields huh? Will we ever? I mean are telescopes being designed or sent to space for this purpose in the future? Wouldn't that be a good way to refine predictions and maybe even add more data to simulations?

*bill\_cooke*: No, telescopes would find it hard to see comet debris in the visible spectrum. Spitzer was able to see comet dust in the infrared, but observing time on infrared telescopes is difficult to get.

bob12: Even though the "peak" time is tomorrow, with about 100 meteors per hour, could that amount happen in the next few hours? (We are at 42 meteors per hour right now according to IMO)

*rhiannon\_blaauw*: It is unlikely. Though it would be fun! We would love to see high rates here.

*rhiannon\_blaauw*: Thank you all so much for your questions and for joining us tonight! We hope you learned something and get to see many Perseids this year!

*danielle\_moser*: Good night all!

huskerguy05: Not a question, but just an extra piece of information Brooke - Last night I was observing and saw two very impressive trails streak by around 1:30-2:00am CDT

*moderator\_brooke*: Husker, you got an amazing show. You were lucky!

topgunphantom: what causes meteors to fall from the sky and onto land?

*bill\_cooke*: The meteors are travelling through space and collide with the Earth. Very few ever make it to the ground.

David: Good night! Thanks again!

*bill\_cooke*: You are welcome!

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topgunphantom: good night guys and thanks again

*bill\_cooke*: You are welcome.

*moderator\_brooke*: And that's our chat! Thank you all so much for being here, and thank you to our team of experts, Bill, Danielle, and Rhiannon. Check back next week for a transcript of tonight's chat. Also, the live Ustream feed will remain up over the weekend, so please check it tomorrow night if you'd like to watch the exciting peak of the shower. Have a great night!

Gemini83: Thanks for all the great info, look forward to doing this again in mid-december, you guys always answer most of the questions that have been on my mind for many years, Im gonna start wrting them down because I forget lol. Thanks again, goodnight

*moderator\_brooke*: It was our pleasure, and we appreciate you being here, very much. Have a great night!