

**Geminids Meteor Shower: 'Up All Night' With NASA!**  
**Experts Dr. Bill Cooke, Danielle Moser and Rhiannon Blaauw**  
**December 13, 2012**

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*Moderator\_Brooke:* Welcome to the Geminids chat! Let's talk meteors with Dr. Bill Cooke...

Chantel: What time will the shower be at its peak? (EST)

*Bill\_Cooke:* 3 a.m.

Druiditup: What is the best time to view the shower?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Matthew\_Pierce: Can we expect many showers like this in 2013?

*Bill\_Cooke:* There will be the Geminids around this time in 2013. Also, the Perseids in August will put on a good show.

Pattykc: I live outside of Fulton NY which direction should we look at more Syracuse or Oswego? Thanks for any information.

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

snickdoodle2737: will it show in Georgia

*Bill\_Cooke:* Yes, it's already underway.

Lori: what is the estimated amount of meteors per hour

*Bill\_Cooke:* At peak, around a hundred per hour.

FabriceD: Why were they called "the Geminids"?

*Bill\_Cooke:* Because they appear to come from the constellation of Gemini.

mccaleb88; what is one of the most fascinating showers?

*Bill\_Cooke:* This one. It is unusual because the meteors come from an asteroid, not a comet.

K: I have seen already about 20 shooting stars

*Bill\_Cooke:* Congrats!

KPlovesstars: How often can one expect a meteor to appear?

*Bill\_Cooke:* At peak, about one a minute.

EB22: will you be able to spot them if it is cloudy in the area?

*Bill\_Cooke:* No, you need clear skies.

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DonTheBeekeeper: So if we're on the east coast we should be looking almost straight up now to find gemini?

*Bill\_Cooke:* No, Gemini is over on the eastern horizon, but to see meteors you need to look at the entire sky because they can appear from anywhere. So look straight up lying on your back.

Nathan: when it going to start

*Bill\_Cooke:* After midnight, local time.

Gihzmo: I have seen quite a few already tonight. At the peak at 3 AM EST, how many do you expect to see per minute?

*Bill\_Cooke:* Around one to two per minute.

reevesa70: how well will we be able to see the shower near lake of the ozarks in missouri

*Bill\_Cooke:* If the sky is clear and there are no bright lights around, you should have a good show.

brax10bell: where should i look in the sky?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

David\_: Is this connected to the end of the world?

*Bill\_Cooke:* No.

AMAC: WILL I BE ABLE TO VIEW IN THE CITY LIGHTS OF DALLAS TX OR WILL I NEED TO DRIVE AWAY IN ORDER TO VIEW IT. WHICH DIRECTION SHOULD I LOOK FOR THEM

*Bill\_Cooke:* You will only be able to see the brighter meteors, maybe ten per hour. If you want to see more, you need to leave Dallas.

Aren: well the shower look like fast streaks or like shooting stars?

*Bill\_Cooke:* Shooting stars are fast streaks of light.

DrewAndAllie: Are there any chances for meteorites?

*Bill\_Cooke:* No.

Eric: Does the shower cover the whole sky or only sections?

*Bill\_Cooke:* Whole sky.

HelloKristy: Do you think I will be able to view the shower with the glow of street lights around me? :(

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*Bill\_Cooke:* Going to be very difficult. You will only see the brighter ones.

aqualux: How many years from now will until this meteor shower burns out?

*Bill\_Cooke:* The Geminids will occur in December for many decades to come.

BeeAye: what direction in the nights sky do i look?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Mike\_F: I've been seeing 1 to 3 per minute here in PA, since about 10:15

*Bill\_Cooke:* Congrats!

*Moderator\_Brooke:* From our astronomers: the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness.

kimiata90: If we go out at 2:30 to 3:00, where in the sky should we be looking -- straight up, or to the east?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Amy: What about tomorrow night?

*Bill\_Cooke:* You will see Geminids tomorrow night, but they will be fewer in number.

Wt: how do I know where to look? I gather it's towards the east -- what more do I need to look for?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

jsa682: where is the live stream facing?

*Bill\_Cooke:* The camera in the live stream is facing north.

jeff44663: Is there any likelihood that any of the Geminids will reach the ground?

*Bill\_Cooke:* Geminids burn up about 45 miles above your head, so no.

PatrickT: What direction should I look in the sky? 5th grader in Illinois!

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

*Moderator\_Brooke:* Thanks for your patience tonight! We're having a tremendous response, and our team is working hard on answering your questions...

GOCMA: How can metors be forecasted? In other words, what makes tonight a known "peak"?

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*Bill\_Cooke:* In this case, experience. The Geminids occur whenever Earth crosses this same position, which is mid-December.

Ricklucy: wil we be able to see tomorrow night - tonight is a school night?

*Bill\_Cooke:* Yes, but the rates will be less.

FLGeminid: When is it best to view in Florida?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Td: will there be a new meteor shower debuting tonight (along with the geminids)? can you tell us more about that?

*Bill\_Cooke:* There is a chance that a new meteor shower produced by Comet Wirtanen will be visible on nights this week in the early evening. If they appear, the meteors will be slow-moving and appear to come from the constellation of Pisces the Fish.

Swatcats: will thier be a lice ustream or jsut that recording?

*Bill\_Cooke:* Yes, the video is live.

Rooster17; will there be a live video of this event?

*Bill\_Cooke:* Yes, the video is live.

Tellitete: Is there a "best" direction to view?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Shoosh: is there any specific direction i should be looking in the sky?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Kellyjo: Is there any particular direction we should look towards (NSEW)?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Khajoo: What exactly is the meteor (trying to explain to my first grade kid)?

*Bill\_Cooke:* A meteor is the streak of light produced when a space rock burns up in the atmosphere.

christine.m.lee : From my daughter, "do NASA scientist still wish on shooting stars"

*Bill\_Cooke:* All the time.

RobS : I was told that this shower is caused by the debris from an asteroid. Is that correct?

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*Bill\_Cooke:* Yes. Geminids come from the asteroid 3200 Phaethon.

JessReinke: Are there areas it won't be visible?

*Bill\_Cooke:* Folks in Antarctica can't see Geminids.

BethRitterGuth: Thank you, Dr. Cooke, for joining us. I am with my son (he is 11), and he has waited all day to ask you questions. He would like to know what kind of an impact a meteor shower has on the Earth.

*Bill\_Cooke:* Meteor showers produce spectacular displays in the sky and may pose a danger to spacecraft, but have very little impact on the Earth.

FLGeminid: how many meteors per hour is there suppose to be?

*Rhiannon Blaauw:* At max you will see 120 per hour.

Bill\_P: How close to the surface of the Earth would a meteor typically get?

*Bill\_Cooke:* Depends on the meteor shower. Geminids burn up at altitudes of 45 miles, but Leonids burn up higher at 60 mile altitudes.

xBrightMag3: Where did the Geminids come from

*Danielle\_Moser:* The Geminids are debris from Asteroid 3200 Phaethon

FabriceD: I know that the Geminids come from the object 3200 Phaethon... But what is this object exactly?

*Bill\_Cooke:* It appears to be an asteroid. Some astronomers think it may be the rocky remains of an extinct comet.

KPlovesstars: Will meteors be visible from a downtown area with lots of lights?

*Rhiannon Blaauw:* The brightest ones will be, however you will see many more Geminids if you go out to a location with less light pollution. If you can see the stars of the little dipper you know you are in a pretty good dark area.

Lylia: What is the best place to see the meteor showers in the U.S.?

*Danielle\_Moser:* Anywhere in the U.S. with clear weather and dark skies works. ☺

Bashar: I've never seen a meteor shower before so might go out to the country to watch it. What are you guys expecting for tonight?

*Bill\_Cooke:* Around 3 a.m. local time, you should see a Geminid meteor every minute or so.

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Sandrita: where ca i see Geminids?

*Danielle\_Moser:* Geminids can be seen all over the sky from most locations in the world (with the exception of Antarctica)

FLGeminid: What direction will the shower come from?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Artemis: We can look anywhere? There is no specific region where we have to look?

*Danielle\_Moser:* Yes, just look overhead and away from any bright lights. Geminids will appear all over the sky.

Druiditup: I'm in Orlando is there a particular direction to face ?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

joanne\_r\_: So I live in Santarem Brazil which is called UTC -03:00 so what time should i expect the best showers

*Danielle\_Moser:* Around 2 a.m. local time.

Swoly: can someone tell me if houston texas will be ale to see the shower?

*Bill\_Cooke:* Yes.

Jessican1: Has been determined whether or not there is in fact a second meteor shower simultaneously occuring?

*Rhiannon Blaauw:* We have not confirmed that ourselves yet. Hopefully in the coming days we will be able to identify if any meteors we have seen are came from comet Wirtanen.

Swoly: Can houston texas be able to see them ?

*Danielle\_Moser:* Yes if your weather is clear and you can get away from bright city lights.

Star\_ACdc: I've seen a few nice showers last year, Is tonights supposed to be as good as last years?

*Rhiannon Blaauw:* Even better! With no moon outside the skies will be darker, which means more meteors!

Jerri: will it shoe in DC? or it's too light here in the city?

*Bill\_Cooke:* Yes, but you will need to get away from city lights.

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t215: Saw three within a few minutes already here in Philadelphia, PA.

*Bill\_Cooke:* Congrats!

xBrightMag3: How were they formed?

*Bill\_Cooke:* They may be pieces of a collision between Phaethon and another asteroid.

420: Can you still see some meteors even though its cloudy?

*Danielle\_Moser:* Only EXTREMELY bright meteors can be seen through clouds. If it's cloudy where you are the live feed may be your best bet.

Sam: at what timimgs in chicago?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Harley1951; I have to go outside and ck this out. !!!!!!!!!!!!!!!

*Danielle\_Moser:* Have fun! Stay safe and dress warmly!

DrewAndAllie: Are there any chances for Meteorites?

*Bill\_Cooke:* No.

Rahul\_Mirajkar: Which is the best place to see todays meteor show?

*Rhiannon Blaauw:* In the darkest location. If you are near city lights, try to get away from them. Happy viewing!

641dr3: seen about 40 so far in southern iowa

*Rhiannon Blaauw:* Fantastic! Glad to hear that!

Richard; Im in South Florida, is there a direction best to look?

*Danielle\_Moser:* Just directly overhead works. Take in as much sky as you can with your eyes.

Lylia; What is the difference between an asteroid and a comet?

*Bill\_Cooke:* An asteroid is a large rocky body, where a comet is a large, dirty snowball.

Space\_Sally: Will any of the meteors "land" on earth?

*Rhiannon Blaauw:* No Geminids will. All Geminids burn up by about 45 miles up. However there are other meteors that occasionally land on the earth and become meteorites!

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MKRacing66: What should we expect from this secondary shower from Comet Wirtanen? Will it be in a different part of the sky (if at all) for those on EST?

*Bill\_Cooke:* At most, just a few meteors per hour and they will appear to come from Pisces, which is in the southwest.

Jackyboyee: will they be any other asteroid include in show tonight

*Bill\_Cooke:* No.

emariisa112: Which planet is the large spot straight up and a little bit to the south tonight?

*Rhiannon Blaauw:* Jupiter! ☺

Fernando: What are they mainly composed of?

*Bill\_Cooke:* Geminids are not pieces of ice, like other shower meteors, but appear to be quite rocky. Hard to tell exactly because they never make it to the ground.

Maxfairway: what general direction in the sky is the gemini constellation if you are in washington dc?

*Rhiannon Blaauw:* To the east. However do not look towards Gemini to see Geminids... they will be all over the sky so just look up!

scotty39: does the asteroid itself pass each year?

*Bill\_Cooke:* No.

Lori: When is the next BIG meteor shower going to be.

*Bill\_Cooke:* The next big meteor shower will be the Quadrantids on January 3rd.

acanon40d: as the Geminids first appeared in the 19th century...will they become more or less numerous in the future?

*Bill\_Cooke:* Some calculations indicate the rates will increase over the next few decades.

FLGeminid: Will shower continue for a while after it's a peak is over and for about how much longer?

*Bill\_Cooke:* You will see Geminids for a few nights after tonight, but the rates will be very low after tomorrow.

Lee: Are the Geminids from asteroid debris or extinct comet debris?

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*Rhiannon Blaauw:* Geminids are unique in that they are the only meteor shower that we know came from an asteroid - 3200 Phaethon. Thus Geminids are more dense than other meteors that came from comets.

EB22: is it true that a shower may form from the pisces constellation?

*Bill\_Cooke:* Yes, it is possible a new shower may appear this week with a radiant in Pisces.

Bashar: Can you make a wish on a meteor shower? :)

*Rhiannon Blaauw:* Absolutely! Wish away. ☺

VenturaBeach: Will you be able to see them in the city?

*Bill\_Cooke:* Only the brightest ones and those are only a few per hour.

jthenderson0: Will this be happening at the same time tomorrow night, or just through tonight?

*Rhiannon Blaauw:* Same time! However the rates will be less.

Jenee: how many miles outside a major city do you need to be to see them?

*Bill\_Cooke:* Depends. You need to get away from bright lights.

Rahul\_Mirajkar: Will the other parts of the world be able to see this?

*Rhiannon Blaauw:* All over the world except the Antarctic.

Taliesyn: Do any of these meteors make it to the ground? Or do they all just burn up on entering the atmosphere?

*Bill\_Cooke:* They all burn up.

BethRitterGuth: What is the difference between meteors that come from asteroids or comets?

*Bill\_Cooke:* Astroidal meteors are rocky; meteors from comets are ice.

xBrightMag3: How long have you been studying on this??

*Bill\_Cooke:* Too long. Over thirty years.

SkyWatcher: What type of camera are you using to capture the live feed?

*Rhiannon Blaauw:* This is a Watec camera on a 17 mm focal length Schneider lens. It gives us approximately a 22 by 16 degree field of view. It is pointed north about 61 degrees above the horizon.

David\_: Why exactly is this happening tonight?

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*Rhiannon Blaauw:* Earth is travelling through a stream of debris left by 3200 Phaethon, an asteroid. It takes several days for earth to pass through this stream so we have been seeing Geminids for days, and will continue to see them for days. However tonight has the highest rates.

FLGeminid : how long have the Geminids been going on?

*Rhiannon Blaauw:* They were first recorded in the mid 1800s.

PatrickT: Do the shooting stars come from all directions, or just one?

*Rhiannon Blaauw:* Geminids are coming from the constellation Gemini. However they will appear all over the sky.... but you can notice the tail of the meteors will all radiate from Gemini.

RobS: How big are most of the meteors when they burn up?

*Rhiannon Blaauw:* The ones you see with your naked eye are about cm-sized pieces. The ones in the live-stream are more on the order of mm-sized.

TERRY: Are any expected to make an earth impact? If so what would be the most likelt area of impact?

*Rhiannon Blaauw:* Geminids will not impact the earth. Most have burned up by 47 miles up, and have been recorded as low as 22 miles up, but never landed on the earth as meteorites.

KAD: Thank you for all of your help!!

*Rhiannon Blaauw:* You are welcome! Thanks for joining us!

DonTheBeekeeper: Roughly how big are the pieces of debris entering the atmosphere?

*Danielle\_Moser:* Sand grains to pebble-sized

brax10bell: Will it show in Florida

*Danielle\_Moser:* Yep, if you've got clear weather and dark skies

Syperdistic: Do we know when the first shower occurred?

*Danielle\_Moser:* The first reports of Geminids occurred in the 1860s. Observations in the 1870s cited rates of about 20 per hour.

xBrightMag3: Will this be an eternal meteor shower one that comes every like decade?

*Danielle\_Moser:* The Geminids are active every year. Some researchers have suggested that they'll be gone in about 100 years time however.

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Shawna: My seven year old wants to be woken up to see it when it is at its peak and wants to know what the "shooting stars" are made of?

*Danielle\_Moser:* Rocks, ice, and organic compounds. They travel at 78,000 mph and burn up in the atmosphere, creating a streak of light that we call a meteor. ☺

Rahul\_Mirajkar: Which parts of the world will be able to see this?

*Danielle\_Moser:* High rates persist for almost a day, so most of the world has a good shot at observing Geminids. You'll only miss out if you've got bad weather, bright lights, or live in Antarctica.

Tommy: What would you say the odds are that the Earth will pass though the comet Wirtanen?

*Bill\_Cooke:* It isn't going to come across to Wirtanen. It may come close to debris left behind by the comet.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions -- TREMENDOUS response tonight!

Shirley: The live feed we are watching on line will we be able to see any on line?

*Danielle\_Moser:* You should!!

Spidermonkey: We have already seen several here in Central Indiana :)

*Danielle\_Moser:* That's great!!

Tiara\_: been seeing a few every now and then here in Lexington, KY....when should it be most active?

*Rhiannon Blaauw:* Between 2 a.m. and 5 am local time.

Matthew\_Pierce: Do showers like this ever have pieces land on earth?

*Bill\_Cooke:* No.

audaciousAdvocate: Lots of people asking on how to see them.

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m. Lie on your back and look straight up, no matter where you are.

Question: What year did these December showers originate?

Jlbelieve: what time in west coast

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

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Harley1951: I just seen 3 here in N.E. PA. in a matter of about 3 minutes.

*Bill\_Cooke:* Congrats.

KPlovesstars: A follow-up to "Is this related to the end of the world," do you think the world is going to end?

*Rhiannon Blaauw:* Not related. And no, I do not think the world is going to end. ☺ Go here for NASA's answers to common questions on the world ending:

<http://www.nasa.gov/topics/earth/features/2012.html>

Porkchop: What kind of telescope is broadcasting the ustream

*Danielle\_Moser:* The USTREAM is supplied by video from a black and white, low light level Watec camera with a 22x16 degree field of view.

Mark: It's cold out there, do you recommend a jacket or blanket... (sorry figured you got tired of answering the question which way to look haha)

*Bill\_Cooke:* Anything that keeps you warm.

Hippie1187: I am in Texas and I just seen a couple pass by

*Bill\_Cooke:* Congrats!

amurphy\_25: Why do meteor showers only happen every once in a while? Why not every night?

*Rhiannon Blaauw:* Actually there are often meteor showers active on any given night. But they may produce rates of only 1 per hour. Earth is constantly moving through streams of debris left by comets and asteroids, but only a few times a year do we move through a stream of debris as thick as the one left by 3200 Phaethon, which produces the Geminids.

FabriceD: You said that there are no chances for meteorites, how come?

*Danielle\_Moser:* Geminids travel too quickly. They burn up completely in the atmosphere and don't make it to the ground to become meteorites.

caitlinx3: Hi Bill! How frequently does the Geminids Meteor Shower occur?

*Rhiannon Blaauw:* Every year!

*Moderator\_Brooke:* From our astronomers: the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness.

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kelly511: Has this shower always happend in Dec.? Is there a reason why (like timing, distance, or climate) that makes the Geminids only come once a year?

*Bill\_Cooke:* Because Earth can only encounter the debris left behind by Phaethon at one point and it reaches that point every year in mid-December.

Keltina: Did something occur to change the path of 4179 Toutatis that brought its tail into our path?

*Bill\_Cooke:* Toutatis is an asteroid and it has no tail. Nothing has changed its orbit.

FLGeminid: How old are the geminids

*Rhiannon Blaauw:* The rocks themselves are likely millions of years old, however Geminids have only been observed on earth since the 1860's.

Macedonia: Can we see them from Macedonia?

*Bill\_Cooke:* Yes.

Harley1951: When will be the Peak Rate in NEPA ?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

BethRitterGuth: What tools do you use to measure and photograph or get data from these meteors?

*Bill\_Cooke:* We use low light video cameras and computers to analyze the video to extract speeds, trajectories and orbits.

snickdoodle2737: Will you be able to see it through a window

*Bill\_Cooke:* No, you will need to go outside.

Josh: I live in rural Texas...is there a specific direction where I can see more?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

Pattykc: these wont harm our atmosphere in anyway?

*Bill\_Cooke:* No, they will not.

Andrea: south america will be able to see them?????

*Danielle\_Moser:* Yes. But the Geminid radiant is much lower in the sky for those in the southern hemisphere than in the northern hemisphere. This means people in the southern hemisphere will see lower Geminid rates than those in the north.

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Mate: how visible are the geminids on the West coast?

*Bill\_Cooke:* Just as visible as anywhere else, provided you are away from any bright lights. The shower is best seen after midnight local time with the peak rates around 3 a.m.

Cannelle: Is there a difference in time when they will be better seen in different areas of the country

*Rhiannon Blaauw:* The best time to see them, wherever you are, is 2 a.m. til sunrise. At 2 a.m. the radiant will be the highest in the sky.

snickdoodle2737: Is it showing in Georgia yet?

*Bill\_Cooke:* Yes.

Bob: How big are most of the meteors as they enter the atmosphere ?

*Bill\_Cooke:* About a millimeter in size.

Mdwaterworth: Is the debris falling through the atmosphere or along the rim of the atmosphere?

*Rhiannon Blaauw:* Good question. Both! Depending on the angle at which the Geminid enters the atmosphere, it could be burning up along the rim of the atmosphere, or falling pretty directly through it.

RRfd117: in which direction do me and my volunteer firefighter buddies need to look and in which direction will the meteors be traveling

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are. They will appear anywhere in the sky.

ibujawa1s: geminid is the biggest shower meteor in a year?

*Bill\_Cooke:* Yes, currently the Geminids is the best shower in terms of rates.

EB22: what time tomorrow is the peak?

*Bill\_Cooke:* The peak is tonight.

Bill\_P: Do meteorites burn up due to friction with air or is it because of the air being compressed? I keep seeing the former mentioned, but have also heard the latter.

*Rhiannon Blaauw:* Friction with the air.

sarahbell03: yay I go tin... I would like to know if anyone knows when the prime viewing time might be for Allentown, PA?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

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*Kathy\_Johnson:* I am not sure what I saw tonight but it was amazing. It was 8:00 Central time in Des Moines Iowa, I was walking with a group of people to my car after my granddaughter's Christmas program and I saw a greenish looking light zoom by with a trail. The women next to me said "What was that?" I said I was not sure. We all stood there in dismay as we were all not sure this was as it was fairly close and probably the height of a 7 story building. This was in the middle of the city! A gentlemen ahead of us said it was probably a part of this meteor shower we were suppose to have tonight. That is why I am searching the web. Most amazing sight! Looking this up on line it appears to look like an image of a comet. Is this possible?

*Rhiannon Blaauw:* It was likely a bright Geminid meteor. Nice!

*snickdoodle2737:* Is this why I saw more stars than usual

*Rhiannon Blaauw:* You are probably seeing more stars than usually because there is no moon out tonight! Dark skies = more stars!

*Mk:* in which direction do we have to look?

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

*vghh2714:* It seems cloudy here in West Texas. will we be able to see any?

*Bill\_Cooke:* Needs to be clear to see Geminids.

*Question:* would it be possible for one of them to crash into a satellite?

*Rhiannon Blaauw:* Yes, though it is very unlikely. One of our jobs here at the Meteoroid Environment Office is to create models that will predict the likelihood of this happening.

*Nancy:* What do you think about those who propose to one day mine asteroids?

*Bill\_Cooke:* First, you've got to find asteroids with something worth mining.

*Question:* 45 miles away is awefully near. how far away are the ones that just fly by and how many usually enter the 45 mile range?

*Danielle\_Moser:* Check out this chart: <https://www.facebook.com/photo.php?fbid=449938011732097>

*FLGeminid:* Is 2012 one of the biggest emininid showers yet?

*Bill\_Cooke:* This shower appears much better than in past years.

*Moderator\_Brooke:* Hello everyone -- if you're having trouble seeing the embedded live feed on Ustream, try going directly to the link: <http://www.ustream.tv/channel/nasa-msfc>

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GOLIATHSFB: will this be the last meteor shower of the year and when will be the next if you know?

*Rhiannon Blaauw:* The Quadrantids in early January (Jan 4 is the peak) is the next major shower.

snickdoodle2737: 6th Grader question: Which side is most likely to see it north east south or west?

*Bill\_Cooke:* Doesn't really matter. Geminids can appear anywhere in the sky.

kimiata90: Did you say that we should go out in time to allow our eyes 30 to 45 minutes to adjust to the dark?

*Bill\_Cooke:* Yes.

Rboel: Is the asteroid 3200 Phaethon gone except for the Geminids?

*Bill\_Cooke:* No, it's still there.

James: Can you talk about how you are able to determine so accurately the time these events will occur?

*Bill\_Cooke:* We simulate the meteor shower in a computer and figure out when the particles will intersect the Earth.

snickdoodle2737: 6th grade Q: well I NEVER seen a shooting star my whole entire 12 years. When is the best time to see shooting stars.

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Starman: nice just seen 2 on the live stream

*Danielle\_Moser:* Great!!

drsolaris8: would it be visible from zip code 08854? or from Central New Jersey?

*Bill\_Cooke:* Yes, if the sky is clear.

Twinbone: Does this have anything to do with the 21st?

*Rhiannon Blaauw:* Nope!

*Moderator\_Brooke:* Hi everyone -- on the Ustream feed, very sorry about the graininess. We're having a bandwidth issue that we're trying to resolve. Thanks for your patience -- the good news is that we're seeing some nice Geminids...

Karencita: Saw 6 in a half hour in North NJ, face is frozen but my heart is happy!

*Rhiannon Blaauw:* Great! Glad to hear you saw some. 😊

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Question: How large is asteroid 3200 Phaethon and when is NASA going to blow it up? That thing sounds pretty threatening.

*Bill\_Cooke:* Phaethon is about three miles across and NASA has no plans to blow it up. That would be pretty tough.

Nyrere: why cant people in antartica see the space debri?

*Rhiannon Blaauw:* The radiant (the point in the sky that the meteors come from) is not visible to them. You will only see Geminids if you can see the constellation Gemini. People in the Antarctic can't see Gemini!

Lori: is the peak 2 or three? I have been reading both times

*Danielle\_Moser:* The Geminid radiant reaches its highest point in the sky around 2 a.m. local time. Generally you will see the highest meteor rates at that time. So the hours just before and after 2 a.m. are good for observing high Geminid rates.

Buzzito: To what magnitude do the Geminids rate/rank compared to the stars out tonight? Or say compared to Jupiter for example

*Bill\_Cooke:* Geminids run the full gambit of magnitudes. We've seen very faint ones and some almost as bright as a crescent moon.

Mickeyc: Because its overcast here in Tampa, is there a better website I can watch this event from? Your video says live but the screen is competely black, I do not see the normal stars.

*Danielle\_Moser:* Please try reloading the webpage.

kf1buz: what are they doing on th ISS to keep safe?

*Bill\_Cooke:* Staying inside.

Andrea: can they see them in south america?

*Bill\_Cooke:* Yes.

Macedonia: Can we see meteors from FYROM Macedonia and please tell me after how many hours we can see them ?

*Bill\_Cooke:* Yes, you will be able to see meteors until dawn.

country.gurl12: AT WHAT TIME IN CENTRAL TIME IN THE USA?

*Bill\_Cooke:* 3 a.m. will be the maximum rate.

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Twinbone: Are there any big meteors in this to affect earth?

*Bill\_Cooke:* No.

scotty39: which meteor shower burns closest to the earth's surface?

*Bill\_Cooke:* The Taurid meteors get closest to Earth's surface.

Nyrere: how did Phaethon 3200 come to be a meteor?

*Rhiannon Blaauw:* 3200 Phaethon is not a meteor. However 3200 Phaethon left debris, which the Earth is travelling through, and when that debris burns up in the atmosphere, we see that as Geminid meteors.

MKRacing66: what is the approximate mass per object of the meteors we will see tonight?

*Bill\_Cooke:* One milligram.

DrewAndAllie: What are Asteroids made of? mostly ice right? what else is in them?

*Danielle\_Moser:* Asteroids are made of rocky material and other elements. Some contain carbon; some are rich in iron and nickel.

Rossb: For ham radio, what direction is best to point the beam antennas?

*Bill\_Cooke:* I have no idea. Not an amateur radio person.

Josh: How large are the biggest pieces?

*Bill\_Cooke:* About an inch.

ruben\_m: if I can see Orion and Gemini does that mean I will see it?

*Bill\_Cooke:* Yes.

Chelsea: Do they all completely burn up?

*Bill\_Cooke:* Yes.

Bashar11: At what angle are the meteors coming in?

*Bill\_Cooke:* Depends on the time of night. At 3 a.m., they will be coming straight down.

caitlinx3: Are the Geminids bits of debris that are trailing behind Phaethon?

*Bill\_Cooke:* Yes.

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Lee: Are there any extra precautions NASA or any other agencies take regarding spacecraft or orbital space equipment when entering an area such as the debris field of 3200 Phaethon?

*Rhiannon Blaauw:* Spacecraft has been known to change its attitude (alignment) to protect its more sensitive equipment, and astronauts do not go outside the ISS during increased activity such as the Geminids and other major meteor showers. One of our jobs at the Meteoroid Environment Office is to send the ISS reports of when this will happen.

big\_e: At what timings in Colorado? Please respond.

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Jessamyn\_Stehens : Can people in the USA see the shower

*Bill\_Cooke:* Yes, it's under way.

Shineetina: i want to be an astronaut when i graduation high school next year, which major should i take in university? thank you

*Rhiannon Blaauw:* A lot of astronauts are pilots, though some are scientists. There is no specific major required to become an astronaut... it is a program you apply for after school. Good luck! This is an exciting area to work in!

Kendra\_Delver: Can we expect to see some larger meteors that have longer streaks or will it be mostly smaller and shorter ones?

*Bill\_Cooke:* The fainter meteors will be more numerous than the bright ones, but you should see at least ten bright ones per hour at the peak.

Juanitox: In Chile we seeing some meteorites every 1 or 2 minutes

*Bill\_Cooke:* Congrats!

Mitch: whens the peak of the shower supposed to happen?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Josh: How large do you think the meteors to be?

*Bill\_Cooke:* One millimeter to one inch.

Jonathan: will they be seen from new jersey?

*Bill\_Cooke:* Yes.

sarahbell03: Is 3 am also prime time for Pennsylvania viewing?

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*Bill\_Cooke:* Yes.

The\_Bacon: Will I be able to see it from Shreveport Louisiana?

*Bill\_Cooke:* Yes.

Buzzito: What magnitude are the brightest Geminids?

*Rhiannon Blaauw:* The ones you will see in the Ustream and outside with your naked eye will be between 4th magnitude and -5 magnitude.

caitlinx3: When is the shower from Comet Wirtanen visible?

*Bill\_Cooke:* If it appears, it will be in the early evening some time this week.

Sm: believe just saw one in the 'live' feed !!!!

*Rhiannon Blaauw:* Awesome!

Johnh: What is the speed of the meteors? They move soooo fast !

*Bill\_Cooke:* Geminids move at 78,000 miles per hour.

Ibujawa : I've seen 15 geminid meteor already..it was awesome, does these meteor showers the biggest one that happen in a year? thank you!

*Rhiannon Blaauw:* The Geminids and the Perseids (in August) are the two showers that are best for visual observing. Glad you saw so many Geminids!

Question: so this shower mysteriously appears in 1983, and nobody seems very concerned. i am for sure am. please, if you could reassure me that earth is 110% safe, please state that!

*Bill\_Cooke:* It appeared in 1833 and Earth is perfectly safe.

Carlene: All I am seeing south of Rochester, NY are a few bright spots that I assume are planets or major stars. What should I be seeing?

*Danielle\_Moser:* You are probably seeing Jupiter in the sky right now -- it's pretty bright. Check out some free astronomy programs to figure out exactly what's up right now. <http://www.stellarium.org/> or <http://www.starrynighteducation.com/skychart/>

WilliamK: I can clearly see Jupiter and Orion. Should I be looking near them for meteors or closer to horizon? (South Jersey)

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

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Jessamyn\_Stehens: Can I veiw the show from the United States

*Bill\_Cooke:* Yes.

Luop: Will there be any other showers like this before the year ends?

*Danielle\_Moser:* The Geminids are the best shower in December.

Rahul\_Mirajkar: When will it be at peak in New Jersey?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m. The peak is tonight.

Pattykc: The showers wont harm the atmosphere at all?

*Rhiannon Blaauw:* Nope! This is a natural phenomenon... no harm to the atmosphere. Meteors burn up in our atmosphere every day.

FLGeminid: Some say 3200 Phaethon is part of another asteriod or extinct comet is that true?

*Bill\_Cooke:* Yes. Which one depends on who you ask.

FLGeminid: Who discovered the Geminids?

*Danielle\_Moser:* Read about Geminid history here: <http://meteorshowersonline.com/geminids.html>

Moore: How long is the shower expected to last?

*Bill\_Cooke:* A few more days, but rates will be much lower after tonight.

ILikeStars: Will there be impacts on the Moon that are visible?

*Bill\_Cooke:* Probably later on this week, but you need a decent telescope with a video camera attached in order to detect them.

Twinbone: For the past couple days i saw something like a meteor it was small it looked like it landed and shot back up in the sky and dissapeard do you know what it was?

*Bill\_Cooke:* I have no idea.

snickdoodle2737: Whats a Quadrantids?Is it a fish or a crab or what?

*Bill\_Cooke:* Quadrans is a sextant or quadrant. No animal.

Shatech: if i go in a dark lot will i be able to see even though they are street lights outside??

*Bill\_Cooke:* You will see a few.

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Matthew: Are Geminid rates higher in some parts of the world than others?

*Bill\_Cooke:* No.

Swatcats: how big is asteroid 3200 phaethon and what would it do if it hit the earth?

*Bill\_Cooke:* Three miles across and it will not hit the Earth.

Carlene: Will the shower on January 3 be better than tonight's shower?

*Danielle\_Moser:* The Quadrantids in January have similar rates to the Geminids in December. BUT -- the Quadrantids in 2013 will be affected by a waning gibbous Moon that will severely reduce the number of Quadrantids observed.

ILikeStars: What size are these metors before they begin their entry?

*Bill\_Cooke:* One millimeter to one inch.

Space\_Sally: Where is the asteroid?

*Rhiannon Blaauw:* The asteroid 3200 Phaethon is 1.7 AU from earth and getting further as I type! It has a period of 1.43 years, however, so it will be coming closer to us again soon.

Tiara\_: I live in the city and there are som bright lights, but there is one dark patch where I can see the dipper clearly. Will that be enough to see some of the shower?

*Bill\_Cooke:* Possibly.

Lylia: What is the difference between an asteroid, a meteor, a comet, and a shooting star?

*Bill\_Cooke:* An asteroid is a large, rocky body, a meteor and a shooting star are the same thing, which is the streak of light produced by a meteoroid (small bit of rock or ice) burning up in the atmosphere and a comet is a big dirty snowball usually a few miles across.

Lj: is this Astroidal meteors or comet meteors we're seeing tonight

*Bill\_Cooke:* Asteroidal.

Jessamyn\_Stehens: How long will this last for??

*Bill\_Cooke:* A few more days.

The\_Bacon: Will this be visible in the southern US? What if im in a suburb area?

*Bill\_Cooke:* Yes. You should see meteors if you get away from lights.

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Alana: Is 3am is the BETTER time to watch?

*Bill\_Cooke:* Yes.

Powell: Will there be photos of the Geminid show on nasa.gov tomorrow?

*Danielle\_Moser:* We'll post some on our Flickr feed as well as the NASA Meteor Watch page on Facebook. Additionally, images and videos will be found at [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov)

ruben\_m: will there be some point that there will be a cluster and last more than just a second?

*Bill\_Cooke:* We occasionally see two or three Geminids at the same time. This could be thought of as a cluster.

meteoridfan12345: where in the sky should a person look and around what time will it be most active?

*Rhiannon Blaauw:* Look up. Find an area with a dark sky, lie on your back, and wait for your eyes to adjust to the dark (can take 30+ minutes)...the radiant is highest at 2 a.m. local time so you should see the most meteors between then and sunrise... happy viewing!

snickdoodle2737: What is your favorite part about working in NASA

*Rhiannon Blaauw:* The variety in the work, the amazing people I work with, and being a part of America's space program. Every week holds new exciting tasks.

rtg175: Have there been any sightings yet?

*Rhiannon Blaauw:* Many!

Jabbawack: In detail, how do scientists know exactly how long things have been around in space? How do we know that after so many trillions of years that a sun burns out or a planet implodes? We haven't recorded how long it would take for something like that to happen, so how would we know how long anything has been around or how long it will be around?

*Bill\_Cooke:* If we find a meteorite on the ground, we can measure how long it has been exposed to cosmic rays to get an idea of how long it has been travelling through space. For things like the Geminids, we can do calculations that will tell us how long it will take them to reach Earth.

ILikeStars: How does the ISS handle showers like these? Are they in danger.

*Bill\_Cooke:* ISS has meteoroid and debris shields, so they are in no danger.

Isaacs1982: Can you get hurt from showers like these?

*Bill\_Cooke:* No.

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Bob: I see on a sateslite tracking website that the ISS just cleared New England out toward the Atlantic - Can they look down and see some Geminids?

*Rhiannon Blaauw:* Yes! We have let the astronauts on the ISS know that the geometry is very favorable for them to see Geminids!

Twinbone: How long have you been studying the predicted end of the world on the 21st and did the mayans really predict it or was it just some random person

*Rhiannon Blaauw:* <http://www.nasa.gov/topics/earth/features/2012.html>

Rboel: Do you have live chat feeds often??

*Bill\_Cooke:* During the Perseids and the Geminids.

big\_e: Colorado timings please -\_-

*Bill\_Cooke:* Peak around 3 a.m.

Lj: is this chat just for students or anybody?

*Bill\_Cooke:* It's for anybody.

Sblinde: When will be the most active time tonight, in eastern time, to see the meteors on the livestream? Really appreciate the stream you've set up, as light pollution makes it hard to see anything in my region. Thank you!

*Bill\_Cooke:* Should be around 3 a.m.

Kendra\_Delver: Where is Gemini located in accordance to Orion?

*Bill\_Cooke:* Gemini is to the northeast of Orion.

Rahul\_Mirajkar: When can we expect next meteor show/

*Bill\_Cooke:* The next meteor shower is the Quadrantids around January 3rd.

Doriginal: How many times a year do we get to see meteors?

*Bill\_Cooke:* Meteor showers occur throughout the year, but the best ones are in the last half of the year, August through December.

KPlovesstars: How many meteors are set to appear tonight?

*Bill\_Cooke:* At the peak, you should see around a hundred per hour.

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country.gurl12: For Texas It Will Be 3am?

*Bill\_Cooke:* Yes.

VenturaBeach: What are the chances of one hitting a satellite?

*Bill\_Cooke:* Depends on the satellite, but very, very small.

snickdoodle2737: when will it show in Georgia

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

luv2krie8: I have enjoyed this shower very much. How much longer will it be going on?

*Bill\_Cooke:* A few more days, but the rates will be much lower after tonight.

Watching: would it show in the caribbean?

*Bill\_Cooke:* Yes.

Rboel: with all nighters like tonight what is NASA's coffee of preference??

*Bill\_Cooke:* I do not drink coffee.

Matthew: Why are geminids rates higher this century compared to the 18th/19th century?

*Rhiannon Blaauw:* Great question. Solar system dynamics can push the stream closer/further to Earth. Rates have been steadily increasing since Geminids were first observed in the 1860's, however Jupiter's strong gravitational pull could pull the stream of debris away from Earth in a few centuries.

cpacheco86: is the asteroid Toutatis viewable right now?

*Bill\_Cooke:* Not without a very large telescope.

*Moderator\_Brooke:* To everyone just joining us, a message from our astronomers: the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness.

Mickeyc: Looking straight up from the Tampa area, what's that bright planet? It's the brightest one.

*Bill\_Cooke:* Jupiter.

Freeman: Are there any different streams that might result in future impact?

*Bill\_Cooke:* No.

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Lisa: from what year does these geminids showers come from

*Bill\_Cooke:* The Geminids you see are at least six hundred years old.

meteoridfan12345: At aproximatley what speed will they be coming in? and where in the sky do i have to look in michigan?

*Bill\_Cooke:* 78,000 miles per hour and look straight up.

Jaik: I just saw some outside my appartment, beautiful sight to see.

*Bill\_Cooke:* Congrats!

*Moderator\_Brooke:* Also, everyone, we're working a bandwidth issue on the Ustream feed that's making this look a little grainy. Thanks for bearing with us.

Raikox: will it show in chile, chiloe?

*Bill\_Cooke:* Yes.

beckye93: Do you have any idea when it's supposed to hit in Philadelphia, PA?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

jp\_upton: is the stream in HD?

*Bill\_Cooke:* No.

NB: They are sand grains to pebble-sized?? How are we able to see them so far away? I know they light up when burned but that is SO small!

*Rhiannon Blaauw:* The streak of light is millions of times the size of the meteor. If the meteor is only 1 mm or so in size, the streak of light is at least the size of a battleship. That is how we see these small rocks from so far away!

Space\_Sally: Has the ISS moved out of the way of the meteors?

*Bill\_Cooke:* The ISS is armored and does not need to move out of the way.

jdcowart87: so there is no way at all any of them could reach earth

*Bill\_Cooke:* Geminids never make it to the ground.

Lj: are you watching the same as us, or are you in an observatory?

*Bill\_Cooke:* I am in a room staring at big computer screens.

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ILikeStars: Do you believe the asteroids can be mined?

*Bill\_Cooke:* Yes, they can be mined eventually, but you need a reason to mine them.

kat4556: what will happen on 12/21/12?

*Rhiannon Blaauw:* <http://www.nasa.gov/topics/earth/features/2012.html>

caitlinx3: What do you mean when you say that a constellation can create a meteor shower?

*Bill\_Cooke:* The constellation does not create the meteor shower; the meteors appear to come from that direction.

Jared: will i be able to see this in jersey?

*Bill\_Cooke:* Yes.

Naboo17: are you experts getting a chance to see the show for yourselves?? i hope so!!!

*Rhiannon Blaauw:* We will be done chatting at 2 a.m. local time... just around the peak, so hopefully we will get to see some for ourselves! ☺

Agent\_Hotchner: Which direction of the sky should I look at to see the most activity?

*Rhiannon Blaauw:* Straight up. Lie on your back and let your eyes adjust to the dark. Happy viewing!

scotty39: is there a chance that the main asteroid could collide with earth?

*Rhiannon Blaauw:* No. Its orbit does not take it close enough to Earth.

Jeff\_in\_CT: Is there a way to estimate the size of a meteor while viewing with naked eye?

*Bill\_Cooke:* The brighter the meteor, the bigger it is. A Geminid brighter than Venus is probably a half inch or so in diameter.

Vickiaten: live in nw illinois, think we'll see anything?

*Bill\_Cooke:* If it's clear.

Matthew: Is it normal to see 2-5 meteors per Minute under clear skies & no moon as early as 9:00 p.m.?

*Bill\_Cooke:* It is possible tonight.

Samsanders: I live in West Palm Beach. When will I be able to see the show?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

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mccaleb88: How fast do meteors travel and how fast will they look to the naked eye

*Danielle\_Moser:* Geminids travel 78,000 mph. A Geminid meteor could travel from NYC to LA in about 2 minutes.

Bashar12: Can they damage the ISS?

*Bill\_Cooke:* No, the ISS has meteoroid and debris shields.

Rcoonjr: Can the ISS see this shower? if so would they take pictures?

*Rhiannon Blaauw:* They can see it! However since they are orbiting at 250 miles up, they have to look down to see Geminids. They have taken pictures of other meteor showers for us.

Nauman: QUESTION: IM 12 YEARS OLD AND I WANT TO SEE THIS BUT WHAT TIME WILL THE BEST METEOR SHOWER WILL COME AT CARLISLE,PA

*Bill\_Cooke:* The best rates will be around 3 a.m.

Jessamyn\_Stehens: is there a chance of a shower like this to land on earth ever

*Danielle\_Moser:* Geminids travel too quickly to make it to the ground. They ablate, or burn up, completely in the atmosphere.

meteoridfan12345: My little daughter would like to know where in the sky she should look....she lives in Michigan

*Bill\_Cooke:* She needs to look straight up.

Doriginal: From which meteor have the debris made it to earth?

*Bill\_Cooke:* Meteors from asteroids (not Phaethon) in the main asteroid belt have a chance of making it to the ground.

Vivekbhan: will these showers repeat infinitely every December?

*Danielle\_Moser:* The Geminids are active every year. Some researchers suggest they'll be gone in about 100 years time. But some suggest the rates will keep increasing. Time will tell.

MKRacing66: Does 3200 Phaethon continue to produce debris? Or is this shower the result of a single event?

*Rhiannon Blaauw:* Excellent question. This is not known for sure, however 3200 Phaethon is thought to be an 'active asteroid' meaning it is currently spewing off debris (though not enough debris for us to see

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a tail on it). The question of whether most Geminids are from the slow release of debris from 3200 Phaethon or a single event (i.e. it breaking up in the past), is not known.

JackyDawg: How many Geminids enter the atmosphere in an hour, about?

*Bill\_Cooke:* On the side of the Earth that can see Geminids, somewhere around 500,000 per hour around the peak.

Scmeteoroid: Here in SC I am out in the country and have seen several meteors starting at around 7pm I have seen approximately 15-20 in about an hour total of watching but 3 very large ones that were spectacular! One left a huge trail and another lasted about 7 seconds! Beautiful night.

*Rhiannon Blaauw:* Fantastic! So glad to hear it!

FabriceD: You said many times that the debris disintegrate before reaching earth, but what happens to what's left of them? The gas/dust or whatever is left after they have burnt

*Bill\_Cooke:* The meteors burn up, not disintegrate. Any small pieces of dust will gradually float to the ground.

Frank: Will we see anything like the Leonids of years back any time soon?

*Bill\_Cooke:* No.

Ruy: do satellites get impacted by the debris and if so do they get damaged?

*Rhiannon Blaauw:* Yes, occasionally they do! Though it is rare. One of the main 'products' of the Meteoroid Environment Office (that's us!) are models that predict this risk. This helps engineers figure out how much protection to build onto their spacecraft.

Naboo17: if you were on a plane during this show, would you be able to see some as well?

*Bill\_Cooke:* If the cabin lights were turned off, quite possibly.

\_escobar: how fast do they go?

*Bill\_Cooke:* 78,000 miles per hour.

Freeman: What is the minimum starting size for a rocky meteor to make it to the surface?

*Danielle Moser:* This depends on a lot of factors -- density of the meteoroid, its speed, and entry angle, etc.

Mikeyhayns: Since there is ice on the meteors that means at one point it was water right? Which means it had to be someone stationary. Explain please!

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*Bill\_Cooke:* No, you cannot have liquid water in space. Ice can form out there.

Scmeteoroid: What factors determine the quality of this particular shower from year to year?

*Bill\_Cooke:* Mainly moonlight, but Jupiter's gravity has been gradually tugging the stream closer to Earth, which is why the rates have gone up over the decades.

Pattykc: idk if this is a dumb question but why is there no moon tonight?

*Rhiannon Blaauw:* The phase is very, very low. Also the moon rose in the morning, and set in the evening today (moon rise/set times are related to the phase).

Renee: Is it true that a 2nd meteor shower from the Comet Wirtanen is combined with the Geminids tonight? I read that on the earthsky.org blog earlier today.

*Rhiannon Blaauw:* Yes, it is possible, though not confirmed.

Chef: I just wanted to break the chain a bit and thank all the experts for taking time to come here and answer our questions tonight. I hope you are able to enjoy the show as much as we are!

*Rhiannon Blaauw:* Thank you so much. 😊

Ibujawa: Does astronomers can predict whether a meteor can hit the earth or not? if yes, based on what?

*Bill\_Cooke:* If you are talking about an asteroid, once we detect it, yes, we can tell where it's going and determine if it poses a threat. All we need are some observations using telescopes.

Guest: Are any planets appearing in the live feed? Can you point them out?

*Rhiannon Blaauw:* No planets in the live-feed. However Jupiter is quite beautiful tonight!

KalEl: Will be visible the next nights?

*Bill\_Cooke:* Yes, but the rates will be lower.

\_escobar: but how do they make such a bright light?

*Bill\_Cooke:* Because they are moving so fast, a lot of their energy is converted into light.

Matthew: 8th grade question, why do geminids come in so many different colors?

*Rhiannon Blaauw:* The colors you see may be due to different elements in meteors being ionized. For example, sodium produces a bright yellow color, oxygen shows up as green.

ILikeStars: What size is dangerous for entry into our atmosphere?

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*Bill\_Cooke:* The atmosphere will break apart any meteor smaller than a football field.

kat4556: what will really happen on the 21st??

*Rhiannon Blaauw:* <http://www.nasa.gov/topics/earth/features/2012.html>

Starrynight: how can you tell the difference between a meteor shower and a shooting star?

*Bill\_Cooke:* A meteor shower is a bunch of shooting stars that occur at the same time each year.

Isaacs1982: Are they dangerous to humans? Hit a house, tree or car? I know you said they don't touch...but could there ever be one that would hit ever?

*Danielle\_Moser:* Geminids don't make it to the ground. But slow, dense moving debris occasionally makes it to the ground to become a meteorite. There have been some incidences of meteorites impacting cars -- The Peekskill meteorite in 1992 hit a car. The Grimsby meteorite broke a windshield in 2009. The Sylacauga meteorite went through the roof of a house, bounced off a radio, and hit a person (it bruised her). These instances are very rare.

Fraggle: What would be the best time to view the shower from central Iowa?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

luv2krie8: In another shower I saw one that looked like a fireball that went across the sky. What shower is that from? and what makes it look so beautiful?

*Bill\_Cooke:* What day did you see this?

hawaiiibeachhouse789: im in hawaii what time should i look?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Victoria: When do these showers end?!

*Bill\_Cooke:* In a few days.

Patrick: Can someone tell me when the next Taurid shower will be?

*Rhiannon Blaauw:* The Taurids are in the fall. The Southern Taurids are active from September 10-November 20 with their peak on October 10th, and the Northern Taurids are active October 20-December 10 with their peak on November 12th.

Spacetime: What type of view do they have from the International Space Station? Thank you for the online support!

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*Danielle\_Moser:* Astronauts should have a good view of the Geminids this year with no moonlight to interfere with observations. They'll be looking through the Cupola.

Dave: Where's the best place to look and time if I live in Illinois?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m. Lie on your back and look straight up, no matter where you are.

Bubba: are you telling us that a meteor is only 1 inch in diameter and we can see them burn up from 45 miles away?

*Rhiannon Blaauw:* Yup! You are seeing the streak of light which spreads out to be a million times the size of the particle itself.

redman1137: What has been the largest Geminid meteor tracked by NASA?

*Bill\_Cooke:* About two pounds.

dagon666: do we want to be looking in the direction of the gemini constellation or away from it?

*Bill\_Cooke:* Look straight up.

geminiair92: i liv in lancaster CA, all ive ben seeing all day and evening are thick dark white clouds covering the whole sky.., should i bother wasting my time TRYING to see anything else? lol.. the shower has ben ruined for me by the showers .., or shuld the sky magically be clearing up around here soon..?

*Bill\_Cooke:* You can't see Geminids through clouds.

Resmo: could any piece touch the ground?

*Bill\_Cooke:* No.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between 3-5 a.m. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

CbrRider1: Do I need to be in an area with very little light or can I still see them with some of the ambient light in my area?

*Danielle\_Moser:* You should be able to see Geminids. The more light you have, the less you will be able to see. (Bright light makes fainter Geminids harder to see.)

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jaddaddy01: whats the best time to watch in indiana

*Bill\_Cooke:* Around 3 a.m.

Doug: Has the ISS ever been hit by meteors?

*Rhiannon Blaauw:* Yes, but they have armor to protect them against anything less than an inch in diameter, and nothing larger than that has hit it. The bigger concern is with astronauts. A spacesuit can be penetrated by a millimeter-sized particle. A one-millimeter-sized particle has the punch of a 22 caliber bullet. So you don't want astronauts going out during increased activity!

Rainsparrows: 11 year old question.. how long did you have to go to school to do your job?

*Bill\_Cooke:* Ten years of college.

Gfgfgf: are there any pics taken from ISS?

*Bill\_Cooke:* Maybe. We'll know tomorrow.

Victoria: How Long does the shower last?!

*Bill\_Cooke:* A few days.

physco219: dear mod how long back log are we looking at for our ?s to be answered?

*Rhiannon Blaauw:* Sorry for the delay! We are answering questions as quickly as possible! Have received over 1600 thus far in the first 1 hr 45 minutes.

usnv07: which is the best direction to look for the meteors tonight

*Bill\_Cooke:* Lie on your back and look straight up, no matter where you are.

kp26: is there a high chance of seeing several at once?

*Danielle\_Moser:* I wouldn't say a high chance, no. We saw several instances of 2 meteors at a time, and one instance of 3 meteors at a time, in our all sky camera network last night. :-)

Rigel\_58: What IS the camera point at? Can't figure out the star patterns!

*Bill\_Cooke:* Camera is pointing north above Polaris.

physco219: how wide of a view do we have on the ustream?

*Bill\_Cooke:* Camera field of view is approximately 25 degrees.

Reapers: what way is coming from

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*Danielle\_Moser:* Geminids appear to radiate from a point in the constellation Gemini.

TISHA: I LIVE IN HAMPTON VA IS THIS THE REASON I KEEP SEEING SHOOTING STARS TONITE I SEEN LIKE 3

*Bill\_Cooke:* Yes, there is a meteor shower going on.

Jonesystar: how bout ohio is it lookin to be a good area?

*Bill\_Cooke:* If it's clear, yes.

Rage: which planets can we see tonight, besides jupiter?

*Rhiannon Blaauw:* Mars can be seen only in the early evening - low in the W/SW sky, and Saturn can be seen in the early morning - just before you call is a night after meteor watching all night. ☺ Saturn rises in the E/SE.

Tkaway: finally have great viewing conditions in nebraska for this shower, got the camera charging and ready to hopfully snag a few pics! is it true that there could be upwards of 120 per hour near peak at 2-3am?

*Bill\_Cooke:* Yes.

mccaleb88: what is the most amount of meteors that have been seen in a hour?

*Bill\_Cooke:* Leonids of 1966. Approximately a hundred thousand per hour.

redman1137: To what constellation Geminids fall in to?

*Bill\_Cooke:* Geminids appear to come from Gemini.

Kewldewd: why are some bright and others very dim

*Bill\_Cooke:* A meteor's brightness depends on its size. Larges ones are bright; small ones are dim.

Kris: What is the difference between an asteroid and a comet?

*Bill\_Cooke:* Asteroid is a large rocky body; a comet is a dirty snowball.

Robert: Has the emmision spectrum of the Geminids been analyzed to determine their composition?

*Danielle\_Moser:* There are some researchers that study Geminid spectra. They mainly look at Na and Fe/Mg and Na/Mg ratios to my knowledge.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn

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(your local time) will be the best rates. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

Skybuzzer: Is it possible to see meteor's from comets?? Or are they strictly produced by asteroids?

*Bill\_Cooke:* Most meteor showers come from comets. For example, the Perseids in mid-August come from Comet Swift-Tuttle.

usnv07: how big of a crater would a football sized meteor leave behind?

*Bill\_Cooke:* About one yard across.

ruscle2784: Has anyone seen any on the live Ustream yet?

*Rhiannon Blaauw:* I just did, actually! Was a Geminid as well! Woohoo! Been so busy answering questions I haven't been looking for meteors. ☺

Castle: Any idea how much of what we are seeing is coming from the comet Wirtanen?

*Bill\_Cooke:* So far, I have yet to see anything from Comet Wirtanen.

Shatech: why is it that these geminids are not lightyears away?

*Bill\_Cooke:* Because the solar system is much smaller than a light year.

Skyelanna: Since it is a gas giant, is Jupiter classified as a Star or a planet?

*Bill\_Cooke:* Jupiter is classified as a planet.

physco219: My 6yr old wants to know 2 things 1 Do you wish upon shooting stars? and 2 Are they really lucky?

*Rhiannon Blaauw:* Wish away! We can't scientifically tell you they are lucky... but I think you should encourage wishing on shooting stars. ☺

aister20: Why is it call geminid, does it have a connection with gemini from greek stuff

*Bill\_Cooke:* Geminids appear to come from the constellation Gemini, which is named after the twins of Greek mythology.

iStalkCheese: Is there a way to determine the elemental components of the Geminids? If so, how?

*Rhiannon Blaauw:* Yes, with spectroscopic analysis.

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Stphrs: We have seen alot of action in Kansas tonight, in about 40 minutes we have seen 12 so far. We were fortunate to see one that was larger than the rest and lasted about 3 seconds. I noticed that it was about the same size if not bigger than jupiter. Does that mean it was closer to us or closer in size to Jupiter?

*Bill\_Cooke:* Congrats.

Truthfulthinkin:g What time will the peak occur in Northern VA?

*Bill\_Cooke:* Around 3 a.m.

kp26: Is there a high chance of seeing several meteors at once?

*Bill\_Cooke:* May happen a few times tonight.

Rainsparrows: could you please answer little guys question. how long do you go to school to do what you do?

*Bill\_Cooke:* Ten years of college.

Onepinbarb: does the meteor showers have anything to do with the moon not being out

*Bill\_Cooke:* No.

Va.\_J: Any other web site to find out how many will fall in a certain area ?

*Rhiannon Blaauw:* There are many great meteor websites! [imo.net](http://imo.net) , [amsmeteors.com](http://amsmeteors.com) , and [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov) are ones I would recommend. That last link has the results of our all-sky cameras, posted daily!

reapers from Pittsburgh: what way should people look like east south west north

*Bill\_Cooke:* Look straight up.

Restive: how long is the shower going to last?

*Bill\_Cooke:* A few days.

Restive: What is the Peak time for Est

*Bill\_Cooke:* 3 a.m.

Hunter: can these showers be dangrous?

*Bill\_Cooke:* No.

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Kristin: what are the chances of getting to see 3200 Phaethon?

*Bill\_Cooke:* You need a very large telescope.

TISHA: WHAT EXACTLY IAM I SOPOSED TO LOOK FOR? SHOOTING STARS?

*Bill\_Cooke:* Yes, you should look for shooting stars.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between midnight and dawn. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

me123: why do meteors break up in the atmospher

*Bill\_Cooke:* Because they're moving so fast that the pressure difference between the front and the back causes them to break apart.

RayKitty: Wirtanen is the comet, that will be investigated in 2016, the comet hopper mission?

*Bill\_Cooke:* It is a proposed target for the Comet Hopper mission.

Onepinbarb: whats the best time for Indiana

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Victoria: Is the peek tonight only?

*Bill\_Cooke:* Yes.

Skybuzzer: Which part of the sky should I be looking towards to see the Gemenids?

*Bill\_Cooke:* Look straight up.

Resmo: do you know what is the composition of these fragments?

*Rhiannon Blaauw:* Rock and ice with some organic compounds

SpaceMan: i cant see anything .... it too bright in my city and the live stream is not working

*Rhiannon Blaauw:* I believe the live-stream is working more consistently now! Hope you see some meteors in it.

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Shambal: how long will this meteor shower last? will we be able to see some tomorrow night?

*Bill\_Cooke:* Yes, you should be able to see some tomorrow night, but the rates will be lower.

Kelsey: Could a huge meteoroid/asteroid, like the one in Armagedon, be pulled towards Earth?

*Rhiannon Blaauw:* We will know far in advance, and at this time we can tell you that no known asteroid is going to hit earth.

Eedgar: so no matter where we are at, at midnight is when we'll see it?

*Bill\_Cooke:* No matter where you are, the peak will occur around 3 a.m.

candy8020: 2 pounds enough to kill a person if it struck them while walking?

*Bill\_Cooke:* Geminids never make it to the ground.

Steom: Will we be able to see them tomorrow night also?

*Bill\_Cooke:* Yes.

Annie\_Mo: do all meteorites have names, or are they named only after they hit earth?

*Rhiannon Blaauw:* Meteorites (what it is called once it hits the ground) are named after the location in which they fell.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between midnight and dawn (best rates 3-5 a.m.) From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

Matthew: What will the Ursids produce @ their peak this year?

*Bill\_Cooke:* About 10 per hour at their peak on December 22

asteroid\_: What is the difference between a meteor and an asteroid?

*Bill\_Cooke:* Asteroids are house size and larger; meteoroids are smaller than that

cool\_trying: How long is the shower going to last?

*Danielle Moser:* The Geminids will be active until Dec 17 or so. But the best days to observe are the days on either side of the peak Dec 13-14.

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DoctorReyes: will the shower be visible from anywhere in the World?

*Bill\_Cooke:* Anywhere except Antarctica

AllisonandMariel: With all the activity in the sky, will this interfere with satellite connections (such as TV/Cell phones, etc) ?

*Rhiannon Blaauw:* No

the\_Doc: Seeing one every 30 sec. West of Houston. Better than the live stream!

*Rhiannon Blaauw:* Fantastic! We like hearing good reports like that.

jennifer: i am in north carolina have i missed the show?

*Bill\_Cooke:* Nope - will go on until dawn

shatech: whats the spread of the shower in terms of miles will it be as wide as the earth? thus the reason why we can look straight up from anywhere?

*Bill\_Cooke:* It is much wider than the Earth. A few million miles in fact, which is why you can look straight up from anywhere.

Rainsparrows: we seen 2 meteors at the same time from different directions... what causes this?

*Danielle\_Moser:* There are many different sources of meteors. Right now, for example, several meteor showers besides the Geminids are active. These include the sigma-Hydrids, Monocerotids, the Comae Berenicids, and several others.

FabriceD: What have you learned from studying meteor showers? I'm aware that some of you have been in this field for over 30 years... So I guess that it can be hard to summarize it here but what are you guys looking for? What questions are you looking to answer by studying these meteor showers?

*Rhiannon Blaauw:* Good question. A lot of what we did at the Meteoroid Environment Office is science/engineering crossover. Our main 'products' are models that predict the risk to spacecraft from meteors. So we take data to improve these models. Also to ask science questions such as: at which size range do showers become dominant over sporadic/background meteors. It is fun work!

Tripled: Will the show be visable in California?

*Bill\_Cooke:* Best after midnight, lasting until dawn, peak around 3 a.m.

Matthew: From 8:45 to 10:00 I've been seeing meteors like crazy (20-58) per hour & Now I am barely seeing any. why is that?

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*Rhiannon Blaauw:* We noticed a lot in the early evening, and then a bit of a lull, as well. So be persistent! We are seeing Ito's again.

HannaBanana: I just wanted to say thank you for ustreaming this amazing event for everyone and answering all of our questions. I went out on my roof to watch and started to cry. These are the moments that I wish I could relive over and over. Once again thank you so much.

*Danielle\_Moser:* You are very welcome!

Ndmorespd: Can you speculate on the rate of sightings tomorrow or Saturday night?

*Bill\_Cooke:* Down to about a third of tonight's rates tomorrow and even less on Saturday.

Gauma: what are these meteors made of?

*Bill\_Cooke:* Geminids are from an asteroid, so they are rocky.

Natasha: What is the peak for Central Time?

*Bill\_Cooke:* 3 a.m.

jupiterrising89: have a question is it possible for one of these to hit an orbiting satellite in space?

*Bill\_Cooke:* Possible, but very unlikely.

Skybuzzer: I have read about people saying they "hear" something sometimes when they happen to see a shooting star. Is there any truth in "hearing" one?

*Rhiannon Blaauw:* The very biggest meteors cause a sonic boom. However there are many reports of hissing sounds coming from the smaller ones. The sounds are thought to be due to very low frequency radio waves interacting with the local environment.

bmwm3gtr: can the shower be seen from anywhere north america?

*Rhiannon Blaauw:* Yes

Truthfulthinking: Light Pollution Obscures Meteor Showers If You Live In A City Like I Do Are There Any Good Tips For Seeing Them More Clearly?

*Bill\_Cooke:* Get away from bright lights and find the darkest spot you can.

Onepinbarb: why dont we see the moon?

*Rhiannon Blaauw:* The moon is not up tonight. It is a new moon. That is why your sky is likely darker than normal! And why we are seeing so many Geminids!

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Shawn: Do you collect and record any data from this shower everytime it happens?

*Rhiannon Blaauw:* We are continually taking data of meteors with various sized cameras and radar.

James\_Moffett: with meteors creaying light as they enter the atmosphere are they producing any type of RF frequency

*Bill\_Cooke:* Some meteors (fireballs) can produce VLF (very low frequency) emissions.

Bobwen: Will you have a similar live cam/chat setup for the Quadrantis in early January?

*Bill\_Cooke:* No.

asteroid\_: 10 year old question. What do you like the most of your career ?

*Danielle Moser:* I really get excited about new data, analyzing it, making sense of what I see, and organizing the data in such a way that illustrates interesting results. In this case, every meteor we observe is a new bit of data!

mccaleb88: How do you know about how big the meteors are?

*Rhiannon Blaauw:* Good question. The size and speed of the meteor are big factors in relating the brightness of the meteor to its size. There are equations that we can use to approximate the size of a meteor.

Kelsey: Why is the peek tonight only?

*Bill\_Cooke:* Because after tonight Earth will move further away from the Geminid stream.

Spacemandan: will I be able to see them tomorrow??

*Rhiannon Blaauw:* Yes, you can see them tomorrow night, though the rates will not be as high as tonight.

Natasha: What is the average size of a meteor?

*Bill\_Cooke:* No such thing as an average size.

HUNTER22: can you see it in california?

*Bill\_Cooke:* Yes.

asteroid\_: Will this happen tomorrow?

*Bill\_Cooke:* Yes, but the rates will be lower.

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bmwm3gtr: what is the origin of these objects?

*Bill\_Cooke:* Asteroid 3200 Phaethon.

stargazer13: Has the ISS ever been hit by a Geminid meteor?

*Bill\_Cooke:* No.

Mrsdefo: 3am CST? or what time zone?

*Bill\_Cooke:* 3 a.m., no matter what time zone.

asteroid\_: what do you mean by peak??

*Bill\_Cooke:* By peak, I mean when the meteor rates are greatest.

Rose: can we still see them in cali right now?

*Bill\_Cooke:* Yes.

Michael\_Lee: I see 1 about evry 5-10 min, im here in South Carolina. its pretty awesome, thanks you guys for the live stream. The peak here should be 2:00 AM, correct?

*Bill\_Cooke:* Probably closer to 3 a.m.

Truthfulthinking: What kind of camera is being used in the live stream ?

*Bill\_Cooke:* Watec 902H2 U Video Camera.

Kewldewd: is their a live feed from the iss

*Bill\_Cooke:* No.

Topher: Meteroid = Asteroid?

*Bill\_Cooke:* Meteoroid = very small bit of rock or ice. Asteroid = very large rock.

Tripled: Will any of these meteors hit the earts surface?

*Bill\_Cooke:* No.

Castle: Besides Perseids and Geminids, what other significant celestial events are expected in 2013?

*Danielle\_Moser:* Not sure what you mean by 'significant'. I think all meteor showers are significant, but then I'm biased. ☺ There are a few solar and lunar eclipses. Check out

<http://eclipse.gsfc.nasa.gov/OH/OH2013.html>

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OWENBlackAngel: What is the velocity of the meteors?

*Bill\_Cooke:* 78,000 miles per hour.

*Moderator\_Brooke:* Hi everyone -- we have a lot of new people in and out of the room, so that's why we repeat this message a lot. A huge number of our questions are about general viewing times and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between 3-5 a.m. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

Richard In California: I've seen two over a period of about 20 minutes, in city lights no less. Travelling NNE toward SSW more or less above and below Orion. Does that sound right or am I hallucinating.

*Rhiannon Blaauw:* Sounds right! Glad you are seeing meteors even with city lights!

Amy\_Nogueira: why don't the geminids not make it to the ground?

*Bill\_Cooke:* Because they are moving too fast which causes them to completely burn up. In order to make it to the ground, a meteor must be moving slower than 20,000 miles per hour.

Annie\_Mo: how many miles away from earth are they?

*Bill\_Cooke:* Geminids burn up 45 miles above your head.

HarryPotter12: About how large can a Geminid meteor get?

*Bill\_Cooke:* About the size of a baseball.

yo\_yo: hey bill, are you able to move the ustream camera

*Bill\_Cooke:* No.

shootingstar101: how come the sky is not filled with a bunch of little stars when i look in the sky, eventhough it is cloud free and dark and 1 am

*Danielle Moser:* It's possible that you have cloud cover you can't detect blocking out the stars. It's also possible that you just need to let your eyes get used to the dark. The longer you look the more stars you'll see. You need to give your eyes 30-45 min to get used to the dark.

Jw: how many a hour will the geminids produce at peak

*Bill\_Cooke:* About a hundred to a hundred and twenty.

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Matthew: When will be best time to view tomorrow night/saturday morning?

*Bill\_Cooke:* 2-3 a.m.

PotatoPirate: Do any of these have even a tiny chance of making it through the atmosphere?

*Rhiannon Blaauw:* Geminids, no. They all burn up by 45 miles up. However other meteors have been known to land on the earth as meteorites.

Jenny\_O: how can we know in advance if we just found out of this

*Rhiannon Blaauw:* Keep an eye on [nasa.gov](http://nasa.gov). We advertise these meteor shower chats a few days or weeks in advance.

Rbeauchemin: Hi there and thanks for being here to answer all the questions! I was curious, if meteors typically come from comets and happen as a regular event, do the comets eventually 'run out' of stuff to break apart and produce meteors and cease to exist? Or do they replenish their mass as they travel around the sun?

*Bill\_Cooke:* Yes, comets eventually run out of stuff. They do not replenish their mass.

carol\_and\_nick: Hi Danielle, we live in NY, in which direction should we face for the best viewing?

*Bill\_Cooke:* Look straight up.

Amy\_Nogueira: where do the geminids come from

*Bill\_Cooke:* Asteroid 3200 Phaethon.

Ogmond: will any of the meteors hit the earth?

*Bill\_Cooke:* No.

Onepinbarb: does this have anything to do with the planets alingments?

*Bill\_Cooke:* No.

jay\_moon: will we beable to see any tommarow night

*Bill\_Cooke:* Yes, but the rates will be lower.

Loco: Do you think the world will actually end on 2012?

*Rhiannon Blaauw:* No . <http://www.nasa.gov/topics/earth/features/2012.html>

Castle: Is it correct to collectively categorize meteors and meteorites as meteoroids?

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*Bill\_Cooke:* No.

CosmicTheory: Are the Germinids every year?

*Rhiannon Blaauw*Yup! Though this year is a particularly good year to view since there is a new moon... so no light from the moon will detract from the meteors!

Loco: What is producing these asteroids, and if it happens ever 30 years or so, why doesn't what ever is producing them run out?

*Bill\_Cooke:* I don't understand your question.

yellafella30: when do the orionids happen again?

*Bill\_Cooke:* Next October.

Jenifer: im in southern cali. will we be able to see

*Bill\_Cooke:* Yes.

Kdiddy: Thank you, experts, for an awesome study break during finals! Maybe too long of a study break.. :)

*Rhiannon Blaauw:* So glad you stopped by!

Rose: why do they come so close to our atmospher?

*Danielle\_Moser:* Meteor showers are caused when Earth runs into a stream of debris left behind by a comet or, in the case of the Geminids, an asteroid. When the debris enters the atmosphere it ablates away and emits light that we see as a meteor.

shootingstar101: what will happen when the peak occurs?

*Bill\_Cooke:* The meteor rate will gradually increase. There will be no sudden outbursts at the peak.

Kym: I haven't seen any on the live stream Is it me or have I just missed them?

*Rhiannon Blaauw:* We have been seeing meteors on the live-stream. Average about every 5-10 minutes currently, so be patient! That rate should increase as the night goes on.

Yurian: i've seen 8 so far here in Hawaii....seeing these fantastic view suddenly made me want to study astronomy..

*Rhiannon Blaauw:* It is a fantastic area of study! I highly recommend it.

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Johnny\_in\_Nova\_Scotia: Does the angle at which the meteor enters Earth's atmosphere affect the intensity of its burn as observed from earth? Or is it just a question of mass? Composition?

*Bill\_Cooke:* It mainly depends on mass and speed.

candy8020: will you guys post any videos of these showers tonight to be seen by those of us who dont manage to see any

*Danielle\_Moser:* We post images and videos every night from the NASA All Sky Fireball Network at [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov). ☺

aister20: would 3am be the best time to see it?

*Bill\_Cooke:* Yes.

OWENBlackAngel: How fast do these meteors travel?

*Bill\_Cooke:* 78,000 miles per hour.

TheHunter: What's the best time for people watching in Hawaii?

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

Goggio: why cant i see anything in los angeles, the sky is clear now

*Rhiannon Blaauw:* Perhaps you have too much light pollution. Try to drive out to an area with darker skies. Also it is fairly early in LA... more Geminids will be seen a little later on for you!

Lessle: How are asteroids formed in the first place?...where do they come from?

*Rhiannon Blaauw:* Debris left over from the formation of the solar system... very old!!

Rainsparrows: what makes these? ( 11 year old)

*Danielle\_Moser:* The Geminid meteor shower is caused when Earth runs into a stream of debris left behind by asteroid 3200 Phaethon. The debris disintegrates in our atmosphere and we see it as a streak of light known as a meteor.

KindOne: has the moon ever been hit by any asteroid?

*Bill\_Cooke:* Yes, look at all the craters on it.

gnw1209: whats the minimum visibility to be able to see this shower?

*Bill\_Cooke:* You can see bright ones under almost any conditions. To really get a decent show, you need to be able to see the stars in Orion's belt very clearly.

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i\_want\_to\_believe: I'm in brazil, can i see it too?

*Bill\_Cooke:* Yes.

Skybuzzer: How does the ISS avoid a meteor field? Change of trajectory or are most of them small enough to be stopped by the armor it has?

*Bill\_Cooke:* ISS has meteoroid and debris shields, so it does not maneuver out of the way. The armor stops them.

Tammy: Will we be able to see these tomorrow too?

*Bill\_Cooke:* Yes, but there will be fewer of them.

jay\_moon: is you job on a night like tonight like a super bowl party

*Danielle\_Moser:* It has a bit of party feel to it, yes. Especially when we are seeing a lot of meteors! 😊

JakeyJohnston: AM I STILL ABLE TO WISH UPON A METEOR?????????????

*Bill\_Cooke:* Feel free.

Dd: Will any of the meteors be large enough to make it through the atmosphere? If so where would they land?

*Bill\_Cooke:* No Geminid will make it through the atmosphere.

Kerri: Will I be Able to see them from New Orleans, la.?

*Bill\_Cooke:* Yes.

JAWS: How large is Phaethon?

*Danielle\_Moser:* Phaethon has a diameter of about 3 miles.

Gus: this phenomenom has something to do with the objects captured by the soho lasco c3 on 12 december 2012

*Bill\_Cooke:* Has nothing to do with it.

diego\_1: how can you keep track of where they come from?

*Bill\_Cooke:* By calculating their trajectories and figuring out their orbits.

toby789: Thank you ladies and gentlemen of NASA

*Rhiannon Blaauw:* You are so welcome! Thanks for being here.

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Cannelle: How fast are they traveling as they go across the sky?

*Danielle\_Moser:* Geminids travel 78,000 mph. This is about 500 times faster than the fastest steel roller coaster in the world, Formula Rossa in Abu Dhabi. ☺

Wildcat\_Duran: are they visibale currently in Mountain time?

*Danielle\_Moser:* Yes they are.

RayKitty: Predicted 6 meteor showers for the year 2013, will they be as visible tonight?.. Are some of these meteors considered to be seen an "earthgrazer

*Rhiannon Blaauw:* Earthgrazers generally are seen in the early evening when the radiant is low in the sky. Tonight's display of Geminids is particularly nice since there is no moon (the moon sheds light on the sky and hampers meteor observing!)

Kimi: I've always had a fascination for science and it was my best subject in school; but roughly how many asteroids are in the asteroid belt between Mars and Jupiter? And how often do they hit these 2 planets?

*Bill\_Cooke:* There are several hundred thousand asteroids in the main belt. I do not know how often asteroids hit Mars and Jupiter, though we have seen at least two hit Jupiter in the last year.

lucky\_star: you mentioned that Geminids never hit the ground...why?

*Rhiannon Blaauw:* We have seen many, many Geminids in our meteor cameras, and they have all burned up by 22 miles above the Earth's surface, most have burned up by 45 miles up.

shootingstar101: when is the next geminids meteor shower?

*Rhiannon Blaauw:* Next year - same time. ☺

the\_Doc: I got to see a fire ball (my third!) last Thursday in Houston traveling NE/SW. that made local news. Was there any other confirmations around the U.S as to additional sightings? Thanks!

*Bill\_Cooke:* What time last Thursday?

aister20: why is it name geminids

*Danielle\_Moser:* Meteor showers are named after their radiant -- or the point in the sky from which the meteors appear to originate. The Geminids are named for the constellation Gemini. (Similarly, the Perseid meteor shower is named for the constellation Perseus, and the Orionids are named for the constellation Orion.)

speterson5: Any suggestions if it's cloudy in my area and I can't see many stars now (in Madison, WI)?

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*Bill\_Cooke:* Hope the clouds break.

Tasha: What is the ISS?

*Rhiannon Blaauw:* The International Space Station - an incredible spacecraft!!

[http://www.nasa.gov/mission\\_pages/station/main/index.html](http://www.nasa.gov/mission_pages/station/main/index.html)

LoriG: Would a meteor shower look the same from space?

*Rhiannon Blaauw:* Good question. If you were in space you would have to look down toward earth to see meteors burning up in the atmosphere, but yes it would look similar... streaks of light.

carol\_and\_nick: I am a teacher...is it possible to obtain some of the shower data to use in my classroom?

*Bill\_Cooke:* Go to [fireballs.ndc.nasa.gov](http://fireballs.ndc.nasa.gov) and click on a date to see data on the meteors observed by our cameras on that day.

beedee : Bill, Danielle, Brooke, Rhiannon, you guys rock for doing this QA!! How late are you going to keep it going? You off work tomorrow? :-)

*Rhiannon Blaauw:* Thank you. ☺ It is fun! We will be answering questions for another 1.5 hours... and I will likely sleep in tomorrow and just work a half-day. We will have lots of Geminid data from tonight to work with tomorrow!

RascallyOne: How can the peak be the same all over? Seems if the peak is 3AM CST, it would be 2AM EST.

*Bill\_Cooke:* Because the best rates are when Gemini is highest in the sky, which occurs around 3 a.m. local time, regardless of where you are.

jay\_moon: but if its 3 am in new yourk that means its 1 am here in colorado what am i missing

*Bill\_Cooke:* See reply to RascallyOne.

jacobgin1: can v see them in the middle east?

*Bill\_Cooke:* At night, you can.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between 3-5 a.m. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust

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to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

Shootingstarslouisiana: can we see the shooting stars well from here?

*Bill\_Cooke:* Yes, you can see them from Louisiana.

mv30: Why is the peak viewing time 3am east coast and still 3am for west coast?

*Rhiannon Blaauw:* The height of the Geminid radiant (the point in the sky that the meteors appear to come from), also the position of Earth. As we approach sunrise we are moving into more meteors (think of a car moving along.. more bugs will hit the front than the back), which increases the rate along with the radiant position.

Ameen: When will the ISS be retired?

*Bill\_Cooke:* Sometime after the year 2020.

mccaleb88: About how many meteor showers are there per year? Also how many of them occur every year

*Bill\_Cooke:* There are over 200 major and minor meteor showers, most of which occur every year.

LK: Every once in a while, I will see what looks like a red-colored shooting star. Are they visible in different colors such as white, red, blue, and yellow? Or is this just my eyes?

*Danielle\_Moser:* Reported colors range across the spectrum from red to bright blue. The composition of the meteoroid and the atmosphere determines the colors seen. For example, green is typically due to oxygen in the atmosphere.

Gooby\_Pls: If there is a comet spitting out these asteroids, and this happens every 30 or so years, why doesn't the comet run out of asteroids to spit out? and why don't we see or hit the comet?

*Bill\_Cooke:* Eventually it does run out of material. We don't hit the comet because the debris it ejects are on slightly different orbits than the comets.

iStalkCheese: What are the chances of one of the Geminids exploding during the shower? What would happen if one did?

*Bill\_Cooke:* Geminids don't explode.

Rose: can we take pictures of the Germinids with a regular camera or cell phone? or will it be 2 fast?

*Bill\_Cooke:* Cell phone cameras are not quick enough to catch a Geminid at night.

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orion8191: Are all of these Geminids?

*Bill\_Cooke:* Most of these are.

Wangkai: What is the speed that they fly through the sky?

*Danielle\_Moser:* 78,000 mph -- quite speedy! A Geminid meteor could travel from Paris, France to Tokyo, Japan in about 4 1/2 minutes.

Johnathan: How far do the meteors usually travel?

*Bill\_Cooke:* Many millions of miles.

jacobgin1: can i see them in the middle east (UAE) ? if yes, then what is the best viewing time?

*Bill\_Cooke:* Around 3 a.m. local time.

Theo: why do we get meteor showers?

*Rhiannon Blaauw:* Earth moving through a stream of debris left by a comet or asteroid. Earth will move through the same stream of debris every year at the same time - hence why meteor showers occur yearly!

carol\_and\_nick: do we have to go outside and look up or can we look up through the sky light

*Bill\_Cooke:* You need to go outside.

shootingstar101: do the meteors' dust eventually make it to earth?

*Bill\_Cooke:* Eventually.

BRY: is it possible to find a piece that hasnt completely burned up

*Bill\_Cooke:* Geminids completely burn up.

fluffy101: How fast does a meteor go

*Bill\_Cooke:* 78,000 miles per hour.

Ray: I m in Virgia, can I see it outside?

*Bill\_Cooke:* Yes.

CJcay: Is this the same debris from the comet that came within the moons orbit?

*Rhiannon Blaauw:* No. This is debris from 3200 Phaethon - an asteroid.

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Acctman: whats the optimal view time for the most visible meteorites in south louisiana?

*Rhiannon Blaauw:* Between 2 and 5 a.m. local time.

Tammy: How do you know when we are going to have meteor showers?

*Bill\_Cooke:* Because we can create computer models that tell us when the debris from comets and asteroids will strike Earth.

Craig: there are two possibly very, very bright comets forecasted for next year...could be spectacular!

*Rhiannon Blaauw:* Yes! I am looking forward to seeing what comes of next year's comets.

Rose: if they are the size of softballs how can we see them ? seems a bit small no?

*Danielle\_Moser:* They are traveling incredibly quickly. The streaks of light created as the bodies ablate are quite long, several km.

Talamarr: so this is essentially a pebel shower in cosmic terms

*Bill\_Cooke:* That's one way of thinking about it.

rob7641: so this will happen tomorrow night as well?

*Danielle\_Moser:* You can see Geminids tomorrow night but the rate is likely to be reduced.

JAWS: What's the difference between a meteor and meteoroid?

*Rhiannon Blaauw:* A meteoroid is the particle out in space, when it hits the earth's atmosphere and burns up it is called a meteor. If it happens to survive that to land on the ground, it is called a meteorite.

tagon666: what is the local time of where the live stream is coming from?

*Rhiannon Blaauw:* It is 12:35 here... we are on Central time. Located at Marshall Space Flight Center in Huntsville, Alabama!

Joel\_P: Why do these meteors look like they're coming from Gemini? Is it because the earth is traveling toward Gemini at this time of the year as it arcs around the sun?

*Bill\_Cooke:* It is because the orbits of the meteors intersect Earth's such that the meteors appear to come out of the constellation Gemini.

orion8191: I have been interested in Astronomy all my life. When is the next showing of Halley's Comet? and Why are we seeing this tonight?

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*Rhiannon Blaauw:* Not for a long time - 2061. However if you look for the Eta Aquarid or Orionid meteor showers next year, you are seeing pieces of comet Halley! Pretty cool.

Pa: I've seen one on the ustream !!! woow.....others I Thought I saw but too small to notice...or are my eyes tired and deceiving me?

*Danielle\_Moser:* Great!! Meteors can streak across the video feed very quickly. That makes them difficult to spot. This problem is compounded when the meteor is also very faint!

Kelsey: A shooting star could be either a asteroid or meteor, right?

*Danielle\_Moser:* Meteors are also called "shooting stars" or "falling stars". They can be caused by debris from asteroids or comets.

Joel\_P: Since (I think) the earth travels about 100,000 MPH in its path around the sun, and these are going 78,000 MPH, does that mean they are going away from earth's current movement direction at 22,000 MPH and we are overtaking them?

*Bill\_Cooke:* Earth travels at about 70,000 miles per hour. The Geminids are going 78,000 miles per hour relative to Earth, not to the Sun.

Stephenhawking: How fast are the meteors travelling as they burn in the atmosphere?

*Bill\_Cooke:* 78,000 miles per hour.

Kimi: Which planet gets hit the most by meteors?

*Bill\_Cooke:* Jupiter.

Txylor: Will it peak closer to 2 or 3 am?

*Bill\_Cooke:* 3 a.m.

Annie\_Mo: can a meteor be caught?

*Bill\_Cooke:* No.

CbrRider1: Where can I find the comet paths to understand more about how earth is going through the path?

*Bill\_Cooke:* JPL Near Earth Object Web Site.

Stephenhawking: We are in Ventura and saw 5 within the first 30secs of looking up!

*Bill\_Cooke:* Congrats!

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ibujawa: does these asteroid debris has the same content as rocks on earth?

*Bill\_Cooke:* Pretty much.

aister20: why is it called geminid

*Bill\_Cooke:* Because they appear to come from the constellation Gemini.

speterson5 Why do meteor showers only appear every once in a while?

*Rhiannon Blaauw:* The same meteor showers appear yearly. You will be able to see Geminids next year at the same time. This is because meteor showers are caused from Earth moving through a stream of debris left by a comet or asteroid... and earth will move through that same stream of debris every orbit.

Oscar: what's a new moon?

*Rhiannon Blaauw:* When the phase is at 0... no part of the moon is lit.

Mi\_guerilla: armor? what kind of armor

*Bill\_Cooke:* Debris shields. Metal plates with kevlar between them.

Ron: Sorry if this has been asked, but what time zone is the 3am peak time for? I'm in MST

*Rhiannon Blaauw:* Local time, not specific to a time zone.

Cb: I'm looking around Orion's belt, is that a good place to look?

*Bill\_Cooke:* Look straight up.

Pa: All the falling meteors on this night will follow the same falling pattern? if no why not?

*Rhiannon Blaauw:* All Geminids will all appear to come from the same place in the sky (the constellation Gemini... where the Geminid radiant is), though they will be all over the sky.

the\_Doc: Can you hear meteor strikes inside the ISS?

*Bill\_Cooke:* Good question. Haven't thought about it, but I believe there are reports of cosmonauts hearing debris strikes on the outside of Mir.

Mach: Have man-made satellites been hit by meteors? Do the small ones get damaged or knocked out of control?

*Bill\_Cooke:* Yes, the Olympus satellite was taken out by a Perseid in 1993.

orion8191: Has earth been hit by a meteor?

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*Bill\_Cooke:* It's being hit by lots of them now.

Jay92: So, No matter where you are, 3am is about the est time?

*Bill\_Cooke:* Yes.

speterson5: Where do the names of the meteor showers and meteors come from?

*Bill\_Cooke:* Meteor showers are named after the constellations the meteors appear to come from.

SkinnySkitzo: Will we be able to see them from Oklahoma?

*Bill\_Cooke:* Yes.

*Moderator\_Brooke:* Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between 3-5 a.m. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

5003: been outside for half an hour, couldn't see any. Are you sure it's visible through all of the states? or am i missing something?

*Bill\_Cooke:* Yes, it is visible throughout the US and thirty minutes isn't enough time.

y0dan1ck: can you see the meteor shower from florida

*Bill\_Cooke:* Yes.

Mi\_guerilla: id like to thank you not only for the feed but the question/answer is most enlightening. ive learned more in the last half hour than i expected. what an experience. thank you

*Rhiannon Blaauw:* Fantastic! So glad you enjoyed this.

Hitom: this may sound silly, but do I look straight up? .. to the east? I am in the Detroit area. Thanx!

*Rhiannon Blaauw:* Straight up. Lie on your back and let your eyes adjust to the dark.

Jjong: What are earthgrazers?

*Bill\_Cooke:* Earthgrazers are meteors with long trails extending across the sky.

Td: is it just the geminids tonight or is there a new meteor shower debuting tonight?

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*Rhiannon Blaauw:* Possibly a new meteor shower as well as the Geminids. By far the most meteors you see outside will be Geminids.

KindOne: When will we see Hailey comet?

*Bill\_Cooke:* The year 2061.

StargazerAngel: at around 11pm in kansas i looked to see if i could see any meteors, i saw a few but my question is i saw this really bright star in the sky would that be jupiter?

*Rhiannon Blaauw:* Yes. Jupiter is likely the 'really bright star' you saw.

BRY: is it true the geminids can be as small as a grain of sand?

*Bill\_Cooke:* Yes.

Lj: how does a meteor emit light?

*Bill\_Cooke:* It burns up, which produces light.

Radial: what is Phaethon orbiting? earth or the sun?

*Rhiannon Blaauw:* Phaethon is orbiting the Sun every 1.43 years.

Mike: I am in New Orleans and havnt not seen any which way should I be searching

*Bill\_Cooke:* Look straight up.

Zbeck: Do metores or cometts get sucked into black holes?

*Bill\_Cooke:* If there's a black hole nearby.

Solow: Is this visible from Atlanta? I'm not really that far from Alabama. I've been outside for almost a half hour and I haven't seen one yet.

*Bill\_Cooke:* Yes, it is visible from Atlanta.

Onepinbarb: is there a chance of one ever getting into the earth's orbit?

*Rhiannon Blaauw:* Interesting question! This question has been raised before but so far simulations and models show this it is extremely unlikely that a meteor would ever get captured into Earth orbit.

tagon666: is it true that when the ISS is fully constructed that it will be visible to the naked eye?

*Bill\_Cooke:* The ISS is fully constructed and it is visible to the naked eye when it passes over.

ChinaMike: is it true that most shooting stars are only about the size of a grain of sand?

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*Bill\_Cooke:* Yes.

JakeyJohnston: what do you believe will happen on '2012'.

*Rhiannon Blaauw:* Nothing. <http://www.nasa.gov/topics/earth/features/2012.html>

Kewldewd: are these metors heasing westward? thats my guess

*Rhiannon Blaauw:* They are travelling in different directions all over the sky, however they are all appearing to emanate from the constellation Gemini, where the radiant is.

Joel\_P: Rhiannon gives great answers!

*Rhiannon Blaauw:* Awe 😊 Thank you!

Gypsywyz: rotation of the earth makes it so the position of the constellation is the same at 3am in each time zone

*Rhiannon Blaauw:* Yes. Thank you for the explanation.

Jade: Is the Geminid meteor shower annual?

*Rhiannon Blaauw:* Yes.

CJcay: What are Geminids made of?

*Rhiannon Blaauw:* Rock and ice and other organic compounds.

Tammy: Can these meteors do any damage to satellites?

*Danielle\_Moser::* Meteoroids can damage spacecraft. Luckily this happens quite rarely.

Ron: Thanks for answering our questions. Are you sad that you have to look at a computer screen instead of watching the sky?

*Rhiannon Blaauw:* We will be done here in about an hour - just as the shower is peaking. So we will get to observe it for ourselves. 😊

Beefnut: Why do the gemenids burn up?

*Bill\_Cooke:* Because they hit the atmosphere so fast that lot of heat is generated, which vaporizes the rock.

LOGAN: Is this meteor shower bigger because of the meteor that almost hit earth yesterday?

*Danielle\_Moser:* No

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y0dan1ck: how do you calculate the speed of a meteor?

*Rhiannon Blaauw:* From the background stars. If we see a meteor from two different locations, we can calculate the orbit/trajectory/speed from the background stars in the field of view.

candy8020: these geminds will be travelling much slower in the view of space observers such on ISS since no gravity up there?

*Bill\_Cooke:* Geminids travel only slightly slower in space.

Hemi: how large are these meteors

*Bill\_Cooke:* Dust size to a few inches.

Kewldewd: what shower will annually put out the most per hour

*Rhiannon Blaauw:* The Geminids, Perseids, and Quadrantids.

Yurian: Meteor showers travels fast right?...then why are Geminids here in Hawaii takes long to pass by?

*Rhiannon Blaauw:* Geminids are travelling at 78,000 mph!

Tunechi I just seen a few that appeared a lot brighter then the others and seemed to be extremely close, im in the Eastern Tennessee area btw. what could cause that?

*Bill\_Cooke:* The brighter ones are bigger and make it closer to the ground.

Dot: How far are the Geminds from earth? Do they actually reach into Earth's atmosphere?

*Bill\_Cooke:* Geminids burn up about 45 miles above your head.

geminiair92: is a canon rebel t3i camera capable of catching a shot of a metoer during this or other showers?

*Bill\_Cooke:* Not familiar with Canon cameras so I have no idea.

Zbeck: What is the best time to see the shower in southern california?

*Bill\_Cooke:* 3 a.m.

dracokira1984: Is it common to actually see them break up on entry?

*Danielle\_Moser:* Meteors ablate away and disintegrate as they travel through the atmosphere. Some of the energy is released as light -- this part we see. Occasionally we can resolve fragments breaking off as the meteor is in flight.

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Miro: When is the peak of the Geminids?

*Bill\_Cooke:* Tonight.

Larousse: are meteorites magnetic?

*Bill\_Cooke:* Many are.

Steeler09: Can you guys see them while answering our questions?

*Bill\_Cooke:* No.

Corey: How long dose the Shower Last?

*Danielle\_Moser:* The Geminids will be active until December 17 or so. But the best times to view it are Dec 13-14.

Larousse: is shooting star a memeorite?

*Bill\_Cooke:* A shooting star is a meteor. A meteorite is a space rock you find on the ground.

Josh: When is the next time we'll be able to view a comet?

*Bill\_Cooke:* No idea. Pay attention to the news.

geminiair92: ARE THE CLOUDS IN LANCASTER CALIFORNIA EXPECTED TO CLEAR OUT AT ANY TIME TONIGHT ENOUGH SO TO SUCCESSFULLY VIEW ANY PART OF THIS METEOR SHOWER?

*Danielle\_Moser:* You'll have to check your local weather forecast for the answer to that. ☺

Skybuzzer: They originate in Gemini, but do they all go the same direction?

*Rhiannon Blaauw:* They travel in different directions about the sky, but their tail all leads to Gemini.  
<http://www.facebook.com/photo.php?fbid=403138493078716&set=pb.335587379833828.-2207520000.1355468318&type=3&theater>. This is an image of the Perseids, but shows this clearly.

Johnathan: Do any of these meteors reach out as far as Pluto? Is Pluto really not a planet anymore? How hot are these meteors?

*Bill\_Cooke:* No, Geminids get as far out as the asteroid belt. A meteor reaches about 4000 degrees when it burns up in the atmosphere.

Stephenhawking: Does the meteor dust add to the earth's mass?

*Bill\_Cooke:* Not significantly.

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dewy77: will someone in texas see the same meteor enter that i see in ny?

*Danielle\_Moser:* No they won't. The distance between locations is too great.

JakeyJohnston: how big was the meteor that killed my dinosaur buddies ?

*Bill\_Cooke:* It was an asteroid and it was ten miles across.

snickerdoodle2737: Where does a meteor go when it falls?

*Rhiannon Blaauw:* Most often it completely burns up in the atmosphere. Less than a tenth of a percent of meteors make it to the ground and become meteorites.

mark Following up on @Joel\_P, why does this dead comet hit the same spot every December, does it share Earth's sun orbit time, or is the debris always in the same location (which would not be possible in orbit)?

*Bill\_Cooke:* The debris trail is always in the same location.

calscats24: Is any of the meteors big enough to reach the ground?

*Danielle\_Moser:* None of the Geminids will survive to the ground. They will all burn up completely in the atmosphere.

candy8020: Hi, Im deaf. Unlike the military they dont let deaf people serve active duty, im curious from your perspective being in this profession, do you think being deaf would put a deaf person at any disadvantage to working in this profession. hence could a deaf person do your what you do effectively?

*Bill\_Cooke:* There are deaf astronomers that do really good work.

dagon666: how can you tell the difference between a geminid meteor or one coming from the Wirtanen comet?

*Rhiannon Blaauw:* We can calculate trajectories and orbits for the meteors. If a meteor appeared to come from the constellation Gemini, it is a Geminid.

Tall: Is 3 AM EST also the optimal viewing time for Norfolk, VA? Thanks.

*Bill\_Cooke:* Yes.

5003: what's the best telescop for a beginner?

*Bill\_Cooke:* Unless you are prepared to spend several hundred dollars, get a pair of binoculars.

Bobwen: We have 2 possibly bright comets headed our way in 2013: One in March, the other at the end of November.

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*Bill\_Cooke:* You are correct. Thanks for reminding me.

vr\_: is this metor shower any way involved with the end of the world next week??

*Rhiannon Blaauw:* No.

Ppatel: Can geminids travel out of our solar system?

*Bill\_Cooke:* No.

Shom: I am in India, and its Friday 12 minutes past noon, do I have any chance catching the shower right now ?

*Rhiannon Blaauw:* Not during daylight. Look tonight, though! You will still see lots of Geminids if you have clear, dark, skies.

Mark: Can you explain why 3am is peak regardless of time zone?

*Bill\_Cooke:* Because the best rates are when Gemini is highest in the sky and that occurs around 3 a.m.

Josh: How many meteors actually land on earth per year?

*Bill\_Cooke:* No idea.

Td: in rural areas, could the meteor shower be seen from a 3rd floor balcony?

*Bill\_Cooke:* If there are absolutely no lights.

Opsdj: is the Big Dipper near the Gemini constellation?

*Bill\_Cooke:* No.

Kelsey: *Rhiannon Blaauw:*, how can you seepieces of comet Halley when looking for Eta A quarid or Orionid meteor showers

*Danielle\_Moser:* The Eta Aquarid meteor shower and the Orionid meteor shower are caused by pieces of comet Halley. When you see a meteor from these two showers you are seeing debris from Halley ablating in the atmosphere. Eta Aquarids can be seen in early May. Orionids can be seen in late October.

Jersey: i am in Tennessee when and if will i see the meteor shower tonight

*Bill\_Cooke:* Yes, it's going on now.

Stephenhawking: What percentage of the current atmosphere would the earth need to have for a geminid meteor to reach the surface?

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*Bill\_Cooke:* Have no idea. Haven't calculated that.

*Mary\_M:* You have mentioned that the ISS is safe from this debris, but do you know if those in the ISS feel or hear anything if the ISS is struck? These things are traveling @ 78k mph and the ISS is traveling fast, I would imagine that there is some sort of 'result' of the collision?

*Rhiannon Blaauw:* The ISS is heavily shielded to protect itself from meteors. So the astronauts will not feel anything. However the 'hear' question is interesting as some Russian astronauts claimed to hear pings from meteors hitting Mir.

*Bashaliange:* in which direction is the live feed camera pointing form Huntsville AI?

*Danielle\_Moser:* The camera is pointed north at an elevation of 61 degrees.

*Johnathan:* Do you think any satellites will be taken out in this meteor shower? What is the probability that it will/won't take out one?

*Bill\_Cooke:* Nope. Less than one in ten thousand chance of a satellite being hit.

*rgrewreare:* we able to see this with the naked eye in a city?

*Rhiannon Blaauw:* It is possible to see the brightest Geminids even with city lights getting in the way!

*ChiChiSmiles:* I saw 3 meteors in the five minutes I was outside freezing. It was awesome! So worth it!

*Danielle\_Moser:* That's great to hear!

*Vj:* the expectation was 80-120 meteors per hour..i have been watching the live feed for last 15-20 min. i have hardly seen 3-4..why is that?

*Bill\_Cooke:* 80 to 120 meteors per hour over the entire sky. The live feed only shows a small part of the sky, about 25 degrees.

*hrdnbrg1:* Can you describe the orbit of 3200 Phaethon? Period? Inclination? Intersection with Earth's orbit?

*Bill\_Cooke:* Orbital period is 1.3 years. Inclination of 22.2 degrees. Ascending node (interstecction with Earth's orbit) 265.4 degrees.

*Marrelicious:* Can i see the meteor shower in California?

*Bill\_Cooke:* Yes.

*BRY:* have there ever been any type 1 diabetic astronauts?

*Danielle\_Moser:* Not that I know of. But a Google search may be in order. ☺

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Luciano: will be able to see the meteor shower from Rhode Island?

*Bill\_Cooke:* Yes.

Indiajade: I live around a fair amount of light. Will I still be able to see some?

*Bill\_Cooke:* Only the brightest.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak between 3-5 a.m. From our astronomers, the best way to view Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

Jersey: where will any of these meteor hit in the US

*Bill\_Cooke:* No.

Gbencive: kind of a stupid question, but where in the sky would it be, in say VA?

*Bill\_Cooke:* Look straight up.

Ayanhko: What is the bright star near Pleiades tonight?

*Rhiannon Blaauw:* Not a star, but the planet Jupiter! 😊

Shom: Can you explain the science behind "everyone can watch it around 3 am local time ?"

*Bill\_Cooke:* See my earlier responses.

STARGAZER82: so its because of speed not size that we can see them

*Bill\_Cooke:* The speed is the dominant factor.

Luciano: will we be able to see the meteor shower from rhode island?

*Bill\_Cooke:* Yes.

dracokira1984: Is it common to see them break up on entry?

*Bill\_Cooke:* Occasionally the brighter meteors will fragment.

JonaC: what is the difference between a meteor, a meteorite, and a meteoroid?

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*Bill\_Cooke:* A meteor is the streak of light produced by a meteoroid burning up in the atmosphere. A meteoroid is a small bit of rock or ice out in space. And a meteorite is a space rock that has made it to the ground.

snickerdoodle2737: This may be a silly Q but what constellation is being shown on the video?

*Bill\_Cooke::* I can't see the video, so I don't know.

Dot: Why is Jupiter hit by the most meteors?

*Bill\_Cooke:* Because it's the biggest planet and has the strongest gravity.

Maria: We have a cloudy sky here in Austin, TX, what are the chances of seeing anything tomorrow night?

*Bill\_Cooke:* The rates will be lower, but you will still see some if it's clear.

Seth\_H.: When you see the falling debris how far out are in our atmosphere are those particles from me standing outside on the earth?

*Danielle\_Moser:* Regarding those Geminids we've seen in the NASA All Sky Fireball Network: Geminids are on average detected around 57 miles above our heads. They are on average completely ablated by about 45 miles up. The lowest Geminid fireball height as detected by our network is 27 miles up. Check out the chart at <https://www.facebook.com/photo.php?fbid=449938011732097>

Gus: it's possible that this meteoros impacting a satellite?

*Rhiannon Blaauw:* Yes. Meteors have damaged satellites before. One of the main 'products' of the Meteoroid Environmet office (that's us!)n are models that predict this risk. This helps engineers figure out how much protection to build onto their spacecraft.

tagon666: is there a website that list when the ISS will pass over certain areas and when it can be seen?

*Bill\_Cooke:* [Heavens-above.com](http://Heavens-above.com)

It\_allyssa: Would you be able to see anythin in Las Vegas hypethetically speaking if it was not rainy or overcast outside?

*Danielle\_Moser:* Las Vegas has a lot of light pollution. This will greatly reduce the number of Geminids seen.

Opsdjg: if they are as small as a grain of sand why can we see them? I realize yes they do burn up, but what about naturally accuring space dust, that has to be as at least the size of a grain of sand? shouldnt we see more of that??

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*Rhiannon Blaauw:* What you are seeing is the streak of light caused by that particle burning up in the atmosphere. The streak of light is millions of times the size of the particle. If the particle is only 1 mm or so in size, the streak of light is at least the size of a battleship.

Skybuzzer: How many Geminids from this year have been seen by nasa cameras so far?

*Bill\_Cooke:* As of this morning, we had seen 80 Geminids. Many more tonight.

Sachin: is it visible in california

*Bill\_Cooke:* Yes.

Kendra\_Delver; Will we see any earthgrazers tonight?

*Bill\_Cooke:* Earthgrazers occur in the early evening, so you will have to wait until tomorrow night to see if you see any.

REThomas: Would any strik the ground tonight ?

*Danielle\_Moser:* No Geminids will survive to the ground. They will all be completely ablated in the atmosphere.

BkBLA: What about this new comet from the Pisces Constellation? If we have never encountered it before, how can we predict what the materials are being introduced or what organisms might be in them. Also how big any of the fragments are? what if its frozen gas being tossed off the comet like some garbage? Ok... I know it's several questions.... sorry... just wondering...

*Bill\_Cooke:* Comet Wirtanen is not new. It was discovered just after World War II. It is likely that meteors from this body are icy in nature. No known form of life can survive out in space for any length of time, so there's no organism in cometary meteoroids. Finally, can't tell you how big the fragments are until we see meteors from this comet.

jlrein0729: Is it common for Earthgrazers to look as if there are sparks flying off from it? Are those "sparks" actually parts of the meteor breaking apart and burning up? I saw one meteor leave awesome looking sparks as it flew across the sky. Almost looked like a sparkler on 4th of July.

*Bill\_Cooke:* Earthgrazers can fragment and produce sparks or flares.

Jersey: are meteors radioactive?

*Bill\_Cooke:* No.

MrsMoore: I havent seen anything since 9pm & I've been going outside every 10 minutes.

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*Danielle\_Moser:* Unfortunately, by repeatedly changing locations, you've not given your eyes a chance to get used to the dark. This decreases your chances of seeing meteors. (It takes about 30-45 minutes for your eyes to dark adapt.)

MagicalMer: Will these shooting stars be able to be seen from Ohio?

*Bill\_Cooke:* Yes.

ALMA: whats the difference between meteros and geminides

*Bill\_Cooke:* Geminids are meteors, no difference.

Manasi: So if its cloudy, you won't be able to see anything?

*Bill\_Cooke:* Correct.

Dude; Do you guys answer ALL the questions?

*Bill\_Cooke:* No way we can answer all the questions. We try to get to as many as possible.

JSchmug: What colors do the Geminids usually burn? So far I've only seen bluish colors on the brighter ones, but it's a little hazy where I'm at.

*Rhiannon Blaauw:* You can see various colors in Geminids. A lot of green-ish color reports have been coming in. This is likely a combination of the elements being ionized in the atmosphere, and the way our eye perceives them.

ALMA; whats the difference between meteros and geminids?

*Danielle\_Moser:* Geminids are meteors. A bit of logic for you: All Geminids are meteors. But not all meteors are Geminids.

Qwsr: will this be visible anywhere?

*Bill\_Cooke:* Anywhere but Antarctica.

F: ANY LUCK I'LL SEE ANYTHING IN SOUTH TEXAS????

*Bill\_Cooke:* If it's clear.

strgxr32: is it visible from northern virginia?

*Bill\_Cooke:* If the sky is clear and there are no bright lights around.

Jjong: how rare is it to see an earthgrazer?

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*Bill\_Cooke:* Earthgrazers are pretty rare.

Blueskynoise: Will they be as visible at 4am as they are at 3am?

*Bill\_Cooke:* Pretty close.

Sherrylin: I've never seen so many shooting stars before its so beautiful. when is the next meteor shower or doesnt anyone know?

*Danielle\_Moser:* There are several minor showers going on right now. The next shower with high rates, however, will be the Quadrantids in the January. Unfortunately, the moon will be so bright for the Quadrantid peak that rates will be significantly decreased for visual observers.

Marrelicious: At what time can we see the Geminid Meteor Shower in California? I need to know the time for my zone

*Bill\_Cooke:* The peak will be around 3 a.m.

Enigma: How is it that the meteor shower occurs annually?

*Rhiannon Blaauw:* We see a meteor shower when the Earth moves through a stream of debris left by a comet or asteroid. The earth moves through that same stream of debris each time it orbits around the sun - hence we see meteors from that stream at the same time each year.

norma\_parks: Why do some of the meteors look like they are fluttering? Probably a silly question, but just looks that way to me.

*Bill\_Cooke:* I do not understand what you mean by "fluttering."

Socow: will the meteor shower heat the earth's core?

*Bill\_Cooke:* No.

Josh: Has a meteor killed anyone?

*Bill\_Cooke:* Answered.

Furbeenator: Very informative, thank you moderators for taking your time to answer our questions. Very cool stuff. Does this "belt" of debris exist here all year and we just pass through it each year at the same location, or is the debris orbiting the Sun almost like Saturn's rings?

*Rhiannon Blaauw:* Good question. The debris is orbiting the sun as well (it has its own velocity).

Cw: You keep saying grain of sand is the size. Is that the size we percieve them at or their actual size?

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*Rhiannon Blaauw:* That's the size of the particle. The streak of the light is millions of times the size of the particle

RascallyOne: Thanks for answering questions and such for everyone so we all better understand this. I must leave, the video is freezing up...how much longer will you be "live" here for chat?

*Danielle\_Moser:* Our pleasure! The chat will end at 2 a.m. CST.

calscats24: Ive heard stuff hitting my roof outside. Is any of the debris reaching the ground

*Danielle\_Moser:* No Geminids make it to the ground.

Soundsofblade: DO THESE SHOWERS HAVE ANYTHING TO DO WITH PLANET ALINMENT ON DEC:21?

*Rhiannon Blaauw:* No

Lucent: Will watching the shower tomorrow night be worth it? My area is covered in fog. :( living in a cold valley

*Rhiannon Blaauw:* Yes! Rates should still be high the night after the peak. Worth going out if you have clear skies.

rand0: what is the probablility that a meteor makes it through the atmosphere until impact?

*Rhiannon Blaauw:* The probability a Geminid makes it through is infinitely small, it has never happened before. The lowest a Geminid has come is 22 miles above the Earth's surface. However meteors make it to the earth as meteorites on a daily basis (this is still less than a tenth of a percent of all meteors).

Argus: Is the ISS in any danger during a meteor shower? i understand that the meteors are very small but are traveling about 32km/s. is this enough to damage the station in any way.

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

Fromtibet: Have any been seen from comet Wirtanen?

*Bill\_Cooke:* Nothing so far.

STARGAZER82: is it possible to see a cluster of meteors

*Bill\_Cooke:* Rarely we see two or three Geminids at the same time.

Haley\_: Wheres the best place to find a meteorite?

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*Rhiannon Blaauw:* The arctic or a desert. Easy to spot a black rock on the surface. Plus most rocks found there have come from space as it is not a naturally rocky terrain.

cris2: when is the best time to see them in a mountainous place like West Virginia?

*Bill\_Cooke:* Peak rate around 3 a.m. local time.

19bradley: will the meteor shower peak at 3am EST?in an hour

*Bill\_Cooke:* 3 a.m. local time, so yes.

TAEG: How much do meteorites that have landed on earth usually sell for?

*Danielle\_Moser:* It depends on whether it's been officially deemed a meteorite first and foremost. After that, the price depends on the size and type of meteorite it is as well as how many pieces there are. Meteorites that have a story typically sell for more. If you are really interested, I'd suggest you check eBay or a meteorite forum.

Pistolstar: Are there any other showers that occur on an annual basis?

*Rhiannon Blaauw:* Many! The Quadrantids in January, Eta Aquarids in May, Perseids in August, Orionids in October, and Leonids in November, are other major meteor showers.

DrWilliamsMD: Good Evening/Morning Honor to be part of such event. During this peak will we see any clusters that would be anything of like a fireworks?

*Bill\_Cooke:* Not many clusters, but maybe a few fireballs.

Bellaboom: Where do they come from? The Geminids.

*Danielle\_Moser:* Geminids come from asteroid 3200 Phaethon.

lauraB: there is a large fog/cloud overhead should it clear up in time for peak at 2am?

*Danielle\_Moser:* You'll have to check your local weather forecast to determine that!

aj2372: what's the best time to see it in Austin, TX? and also can you still view it in the middle of the city with all the lights?

*Bill\_Cooke:* Rates will be best around 3 a.m. local time and city lights will definitely reduce the number of meteors you will see. You will only see the brightest ones from the city.

*Moderator\_Brooke:* Thanks for your patience as we answer your questions. Many, many of our questions are about viewing times, and how to view the shower. For viewing times, midnight until dawn (your local time) will be the best rates, with peak 3-5 a.m. From our astronomers, the best way to view

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Geminids is to lie on your back and look straight up, allowing your eyes to take in as much of the sky as possible. You need clear, dark skies away from city lights. Allow your eyes 30-45 minutes to adjust to darkness. Everywhere on Earth except Antarctica may see the Geminids tonight, as long as skies are cloud-free and dark.

Joseph: Can't see anything in Phoenix, Arizona. we have rain clouds and light rain showers blocking the event.

*Danielle\_Moser:* Sorry to hear that! Hopefully you'll be able to see some on the live feed!

BRY: is there a defining characteristic to tell the difference between a meteorite and plain lava rock?

*Rhiannon Blaauw:* Meteorites: Magnetic. Denser than an earth-rock. Often burnt-exterior. Metal flecks inside. Non-porous.

Askpiper: if these were large enough to reach the ground what would the composition of the meteorite be?

*Bill\_Cooke:* Since we have never actually captured a Geminid meteor, we don't actually know.

Rainsparrows: thank you for your q&a . we are getting our blankets and hot coco almost 2 am here.. Happy light show to all. hope you guys get to see some of it.!!! <3

*Danielle\_Moser:* Our pleasure! Hope you have a great time!

TAEG: How much do meteorites that have landed on earth usually sell for?

*Rhiannon Blaauw:* It depends on several things - whether the specific meteorite fall made the news - what kind of meteorite it is (the more rare/expensive are Lunar and Martian meteorites) - etc. Look on eBay for an idea of what meteorites are selling for. ☺

Erin: I have one quick question. The yahoo article I read said that the peak time would be 2AM. Now is that for the east coast?

*Danielle\_Moser:* 2 a.m. your local time

Txylor: Will I still be able to see it at the peak if it is really cloudy? I was just outside for 30 minutes and couldn't see anything.

*Bill\_Cooke:* Can't see Geminids if the skies are cloudy.

vr\_: Are germinids strong enough to do damage to the ISS, possibly destroy or disable it?

*Bill\_Cooke:* ISS has shields that will protect it against the Geminids.

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Dyeske: I'm on the west coast. Has it peaked yet? Should I go out now or wait until later?

*Bill\_Cooke:* Meteor shower is under way. Best rates around 3 a.m.

Josh490: Cloudy skies here. Will the rates still be at their 'max' 4am local time?

*Bill\_Cooke:* Rates still very good around 4 a.m.

P: where should i look in the sky in northwest ohio ?

*Bill\_Cooke:* Look straight up.

Atwal: is any of the meteors hitting the earth surface tonight?

*Bill\_Cooke:* Geminids do not make it to the ground.

MARICELA: CAN I SEE METEOR SHOWER FROM NEVADA

*Bill\_Cooke:* Yes.

Bashaliange: if the camera in Huntsville, Al is elevated at 61 degrees and huntsville is at about 37 degrees north of the equator myself in Detroit at about 42 degrees north would have to look nort at an elevation of about 40 to 50 degrees to seen the same area right?

*Bill\_Cooke:* Right.

Toni: what is the best time to watch the meteors here in california?

*Bill\_Cooke:* Rates are best at 3 a.m. local time.

bob123: Was just outside for 45 min.. Only saw about 10 or so. Hopefully closer to 3am I will be able to see more

*Rhiannon Blaauw:* Glad you saw some! And hoping you'll see more!

Patrick: Can I still see the Geminids if there is a street light near by?

*Rhiannon Blaauw:* It is possible, though getting further away from lights is better.

patrick86: Fluttering=flickering flashing

*Bill\_Cooke:* Bright fireballs that are fragmenting can appear to flicker.

Terri\_Thompson: What is the best direction to watch for the most meteors? I am in Western North Carolina.

*Bill\_Cooke:* Look straight up.

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19bradley: will the meteor shower peak in about 40min which is 3am in ohio?

*Bill\_Cooke:* Yes.

Meteor\_Expert6752: What made you want to become an expert on meteor showers?

*Rhiannon Blaauw::* I did my Master's Thesis on meteors (using radar data), and got into the amazing world of meteor science that way! I was able to be hired on at the Meteoroid Environment Office right after I finished my MSc, which was amazing.

kate\_white: I have not seen anything yet is it over?

*Bill\_Cooke:* It continues until dawn.

Onepinbarb: can this have any effect on our weather ?

*Bill\_Cooke:* No.

Johnny: will this shower be viewable dec 15

*Bill\_Cooke:* May see a few of them on the night of the 15th.

Berom: My friend and I are argueing if we are watching for comet or meteor. Is there a difference between them?

*Rhiannon Blaauw:* Yes. You are looking for meteors tonight. Comets are rarely seen by eye.

Bobwen: Did 10 minutes up on the NYC deck here... saw 10 meteors, including 2 long & bright plus 1 fireball. Definitely go outside and look now! Good night to all and thanks to our moderators and question answerers.

*Rhiannon Blaauw:* Fantastic! Thanks for the good report.

ChicagoDave: How big are they, and how fast are they moving?

*Rhiannon Blaauw:* The meteors you see with your naked eye are about centimeter-size, however the streak of light they create is millions of times that size. And they are moving at 78,000 MPH!

Jersey: Can someone tell me what excatly a meteor shower is and were and how they start?

*Bill\_Cooke:* A meteor shower occurs when the Earth runs into a stream of debris left behind by an asteroid or a comet. They start when the Earth enters the debris trail and end when the debris is no longer close to the Earth's path.

Terri\_Thompson: Is there a prime direction to look toward?

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*Bill\_Cooke:* Straight up.

Steven\_M: I am in Virginia. Will I be able to see this event?

*Bill\_Cooke:* Yes.

Rainsparrows: is there a way to get a transcript of all of the questions and answers tonight. We missed a lot looking up!!

*Rhiannon Blaauw:* A transcript of the questions/answers usually goes up on the site a few days after the chat. ☺ Thanks for your interest!

Question: from what i've read on wikipedia about phaethon 3200, the asteroid will get closer as this century ends. any risk implications for meteorites?

*Bill\_Cooke:* No. Geminids ejected from Phaethon hundreds of years ago.

Suzette: Why do these meteors appear to be bigger and more frequently the Orionid meteor that was earlier this year? (Sorry I know I spelled that wrong.)

*Bill\_Cooke:* Geminids are rocky, so they penetrate deeper in the atmosphere and are often brighter than the Orionids. They are more frequent because there is more debris in the Geminid trail than in the Orionid trail.

Mpdang: I'm pretty sure this has already been asked, but what's the most optimal time to go and watch the Geminid shower?

*Bill\_Cooke:* 3 a.m.

Maggeth: Are comets just balls of gas or is there a solid core?

*Rhiannon Blaauw:* Dirt, rock and ice - dirty snowballs.

Joe: Do you need a telescope to watch the showers in urban areas?

*Bill\_Cooke:* Just use your eyes --- that's the best way to view meteors.

Randy: Which is best direction in the sky to look for most meteors?

*Bill\_Cooke:* Straight up.

Miguelortega: what time will it peak? pacific time?

*Bill\_Cooke:* 3 a.m. local time.

magesh hi: we can see this in india?

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*Bill\_Cooke:* At night, you can.

Moecritter: If we are going through the same debris field every year why don't the meteors every run out or does it just take to many years for the average person to notice the decline of a particular shower?

*Rhiannon Blaauw:* The stream of debris is getting filled with new particles. The particles have a velocity of their own and are orbitting around the sun.

Isabella: geminids are only tonight?

*Bill\_Cooke:* Yes, you can see them from Colombia and there will be Geminids for the next few nights, but the rates will be less.

nessa2012: whats the diffence between metor and geminids?

*Bill\_Cooke:* No difference. Geminids are meteors.

Isabell: is it every year?

*Bill\_Cooke:* Yes.

Magesh: bill cooke-is this visible in india?

*Bill\_Cooke:* At night it is.

mv30: How are you able to tell which meteor comes from where? (re: question about comet Wirtanen)

*Rhiannon Blaauw:* We use the stars in the background to figure out the direction that the meteor was going. If we see the meteor in 2 or more cameras at 2 or more locations, we can use triangulation to calculate trajectories and orbits, which allows us to tell where in the Solar System the meteor came from.

dj\_kellz: Is the Comet Wirtanen going to come into play tonight with the meteors? Or is it just Phaethon 3200?

*Bill\_Cooke:* So far, it's just 3200 Phaethon.

RJDoute: Not a question, but a big thank you to the knowledgable moderators and to NASA for providing the camera.. my 8 year old and I will get to see them one way or another. :) Have a great night!

*Bill\_Cooke:* Thank you.

Berom: What is the difference between a comet and a meteor? If there is any.

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*Rhiannon Blaauw:* A comet is a 'dirty snowball'... a ball of ice and rocks that throws off debris as it comes close to the Sun. The debris that comes off the comet becomes the meteors you see!

Vinnybee: what is the probable size of these single meteors?

*Bill\_Cooke:* Anywhere from one millimeter to one inch.

Kristin: Thank you all for your time and insight! Time for me to take one last look outside then off to bed. Have a great night and happy meteor watching!

*Rhiannon Blaauw:* Thanks so much for joining us!

Teara: Seeing up to 2-4 per minute

*Rhiannon Blaauw:* Fantastic!

Michelle: What time should I watch it if I live in California?

*Bill\_Cooke:* The peak will be around 3 a.m.

JUAN: IM IN DES MOINES IOWA AND JUST SAW A FEW WONDERFUL METEORS

*Bill\_Cooke:* Congrats.

vr\_: How long does it take for the ISS to make a full rotation around the earth?

*Bill\_Cooke:* About 92 minutes or so.

iSilv: I'm in Victoria - BC, Canada, and it's raining a little bit. Will it prevent me from seeing the meteors?

*Bill\_Cooke:* Yep, that will put a damper on meteor watching.

Abhi: is there still a chance to see something from Centreville, VA 20121?

*Bill\_Cooke:* Sure, there will still be a chance up to dawn.

James: Where is 3200 Phaethon now? Is it inside or outside our solar system? If inside, where is it? If beyond, does it still orbit our Sun, or does Phaethon simply float in space? This is the first "extinct comet" I have heard about. Thanks. James in DB, FL

*Rhiannon Blaauw:* 3200 Phaethon is 1.7 AU from the earth, and moving further from us. However it won't be long until it starts coming back towards us and the Sun - it has a short period of 1.43 years. And yes it orbits around the sun.

ChicagoDave: if these are only a centimeter in size, what is the biggest meteor ever recorded?

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*Bill\_Cooke:* Have no idea. Some have been estimated being bigger than large boulders.

Walter: how much of the sky is your camera covering

*Rhiannon Blaauw:* It has a 22x16 degree field of view. It is pointed north, about 61 degrees elevation.

Aeroptic: Okay, quick question: if the particles we see with our eye are only a centimeter big, how do they create such a huge light trail? Does it really ionize that much?

*Rhiannon Blaauw:* Yup! The streak of light is millions of times the size of the particle.

Onepinbarb: This may sound stupid but sunglasses would this help darking other surroundings and give a better look?

*Bill\_Cooke:* Definitely no.

CliffBarrar: We're pretty sure we heard a boom with the big one we saw explode, is that possible?

*Bill\_Cooke:* Some fireballs that get low in the atmosphere can produce sonic booms.

Pa: 25degreesof the ustream on the sky represents 25% aprox? I hope to get my answer...if not ..Thanks any way for your time!! Enjoy the show yourselves!!

*Bill\_Cooke:* It's more like 5%.

a\_jewell: 3 am local time is who's local time ? p, m, c, e ?

*Bill\_Cooke:* YOUR local time.

Abhi: Hi, has the shower peaked already?

*Bill\_Cooke:* The peak is 3 a.m. local time.

Tayler: how long does the shower last?

*Bill\_Cooke:* Be around for the next few days, though the rates will be lower.

maddog812: at what speed do these Geminids traveling?

*Bill\_Cooke:* 78,000 miles per hour.

iSilv: I'm from Vancouver Island. Is it 3 a.m. Pacific Time?

*Bill\_Cooke:* Yes.

Darrellzilla: how long is this shower going on for anyway?

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*Rhiannon Blaauw:* The Geminids will be active until December 17th, but by far the highest rates will be tonight.

Mailesmyth: I thought most of what we see is sand grain size, but I see people quoting centimeter. What IS the norm?

*Rhiannon Blaauw:* In the live-stream the meteors you see are mm-sized. If you go outside and look up at the sky the meteors you will see are cm-sized.

Mailesmyth: can you determine the size of the meteor particle by brightness and the distance it covers in the sky? My best sight was at 11:30, covered 50 degrees, and was visible thru clouds. I'm thinking it might be a BB sized chunk.

*Bill\_Cooke:* The brighter the meteor, the bigger it is. And your meteor might very well have been the size of a BB or larger.

Sohna: Is there a particular part of the sky I should be watching? East, west...?

*Rhiannon Blaauw:* Look up. Lie on your back and let your eyes dark-adjust.

Walter: jow much of the sky is your camera covering

*Bill\_Cooke:* About 5%.

Dchaykas: How long does a meteor shower last on average?

*Rhiannon Blaauw:* A particular meteor shower can last days or weeks, or even months! However the peak is generally a few hours long.

Imagefm: i was just watching from hamilton ontario and i seen quite a few in a 10 minute span

*Rhiannon Blaauw:* Nice!

Missy: Why are they peaking at this time? Does it have to do w/the constellation posiiton?

*Bill\_Cooke:* Yes, it does. The peak rates occur when the constellation is highest in the sky.

jay\_Bizzle: how many are we expected to see? want to go out at the right time to see a bunch

*Rhiannon Blaauw:* You will see max of 120 if your skies are very dark and clear.

Chris11111711: what is the best time to watch tomorrow? I'll be in a darker area.

*Bill\_Cooke:* The shower is best seen after midnight local time with the peak rates around 3 a.m.

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*Moderator\_Brooke* ...and that's a wrap on our 2012 Geminid chat! Thanks for all of the terrific questions tonight from around the world. You can see the Geminids for the next couple of nights, but at a reduced rate from tonight's peak. Have a great Friday, and check back next week for a transcript of tonight's chat.

STARGAZER82: thanks for the great answers guys enjoy the show i know im about to

*Rhiannon Blaauw*: Thanks for being here!

Chris111111711: Thank you!

*Rhiannon Blaauw*: You are welcome!

*Danielle\_Moser*: Goodnight all!

Jojo: are the meteors hotter than Brooke ?

*Moderator\_Brooke*: I promise you, they are. ☺

Bummedinoregon: are you going to leave the stream up

*Moderator\_Brooke*: Yes, it will be up for the next couple of nights.

jenva1: thank you for the show :)

*Moderator\_Brooke*: It was our pleasure.

Suzette: Have a Merry Christmas

*Moderator\_Brooke*: Happy holidays!

DrWilliamsMD: guess ill go to bed and try get some sleep before 12-3am tmw lol

*Moderator\_Brooke*: ☺

Furbeenator: Thanks, moderators and NASA!

*Moderator\_Brooke*: Thank you all for being here -- have a great night! Everyone get some sleep. ☺

Wakawaka: Thanks for hosting the chat! Merry Christmas y'all!

*Moderator\_Brooke*: You bet!