Looking For Meteors In The Night Sky

Grade: 9
Outcomes:
109-11 (relate personal activities and various scientific and technological endeavours to specific science disciplines and interdisciplinary studies)
209-4 (organize data)
210-16 (analyse and identify questions from the data)

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STUDENT WORKSHEETS

TEACHER'S GUIDE

ACTIVITY #1: FINDING THE CONSTELLATIONS IN YOUR NIGHT SKY

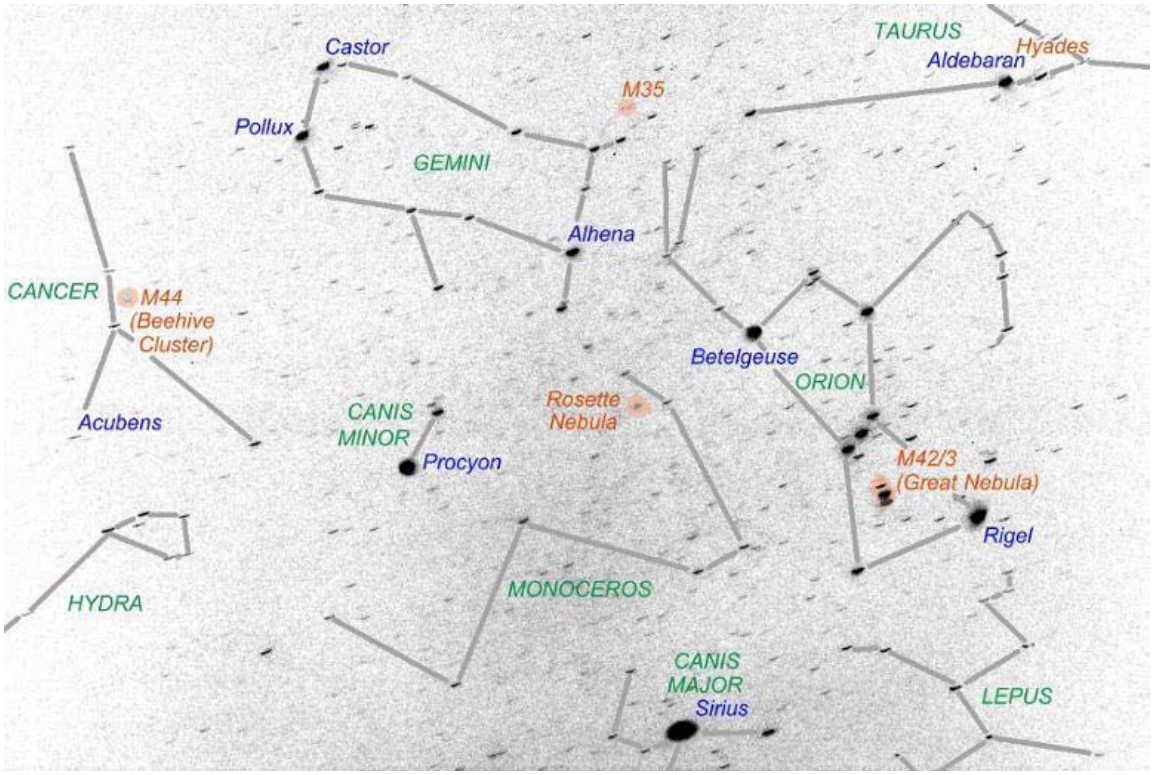
Because the Earth is always moving around the Sun and spinning on its axis, the night sky is changing every night and every hour of the night. Stars and constellations we see in the winter time are not in the same place when seen in the summer. Here we are going to look at some actual images of the night sky in the winter time in New Brunswick and match the constellations we know to be present.

1. Take the images of the night sky on the next two pages and draw out the constellations on the photos using the star charts provided. There are two sets of photos and star charts. The first set is to help you identify some key constellations like Orion, Gemini and Monoceros. The second set is a broader image of the night sky in the northern hemisphere in winter.

Start first by orienting north on the photo with north on the star chart. Remember the key features you use to pinpoint the constellations, you will be using these later on!

2. Identify as many constellations as you can and around the greatest area on the photo as possible.

IMAGE SET 1



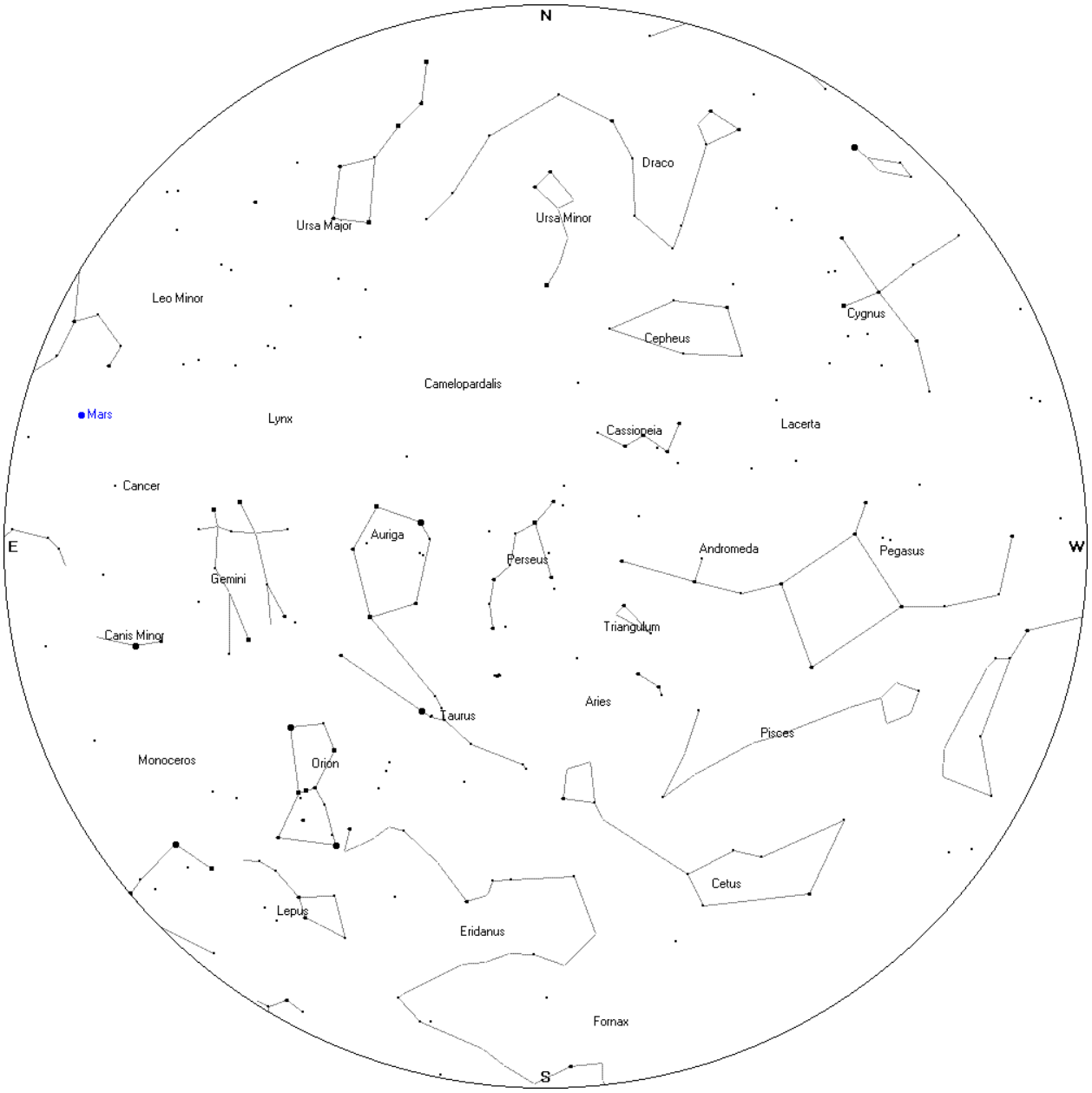
Images from: http://homepage.ntlworld.com/mjpowell/Astro/Night_Sky.htm Martin J. Powell

IMAGE SET 2

Image from www.astronomyonline.org.

IMAGE SET 2 continued overleaf

IMAGE SET 2 CONTINUED



ACTIVITY #2: DETERMINING RADIANTS

Radiants refer to the "apparent" origin of meteor showers. Many showers are predictable and can usually be seen originating from a specific point in the sky. We use the locations of the constellations to give a reference point for those origins. To determine the apparent origin of the meteor shower, we need to observe the path of the meteor in sky. By noting two stars that a meteor's path crosses, we can draw a line connecting those stars. If we continue to draw the line back far enough on a star chart we can find the constellation the meteors seem to originate from.

Using the special photograph of a meteor shower on the next page, we can situate the constellations we see and use the meteor path to determine the radiant. With the origin known, we can check the list of known radiants that correspond to known sources of meteors. Any meteors without a known source are said to be sporadic.

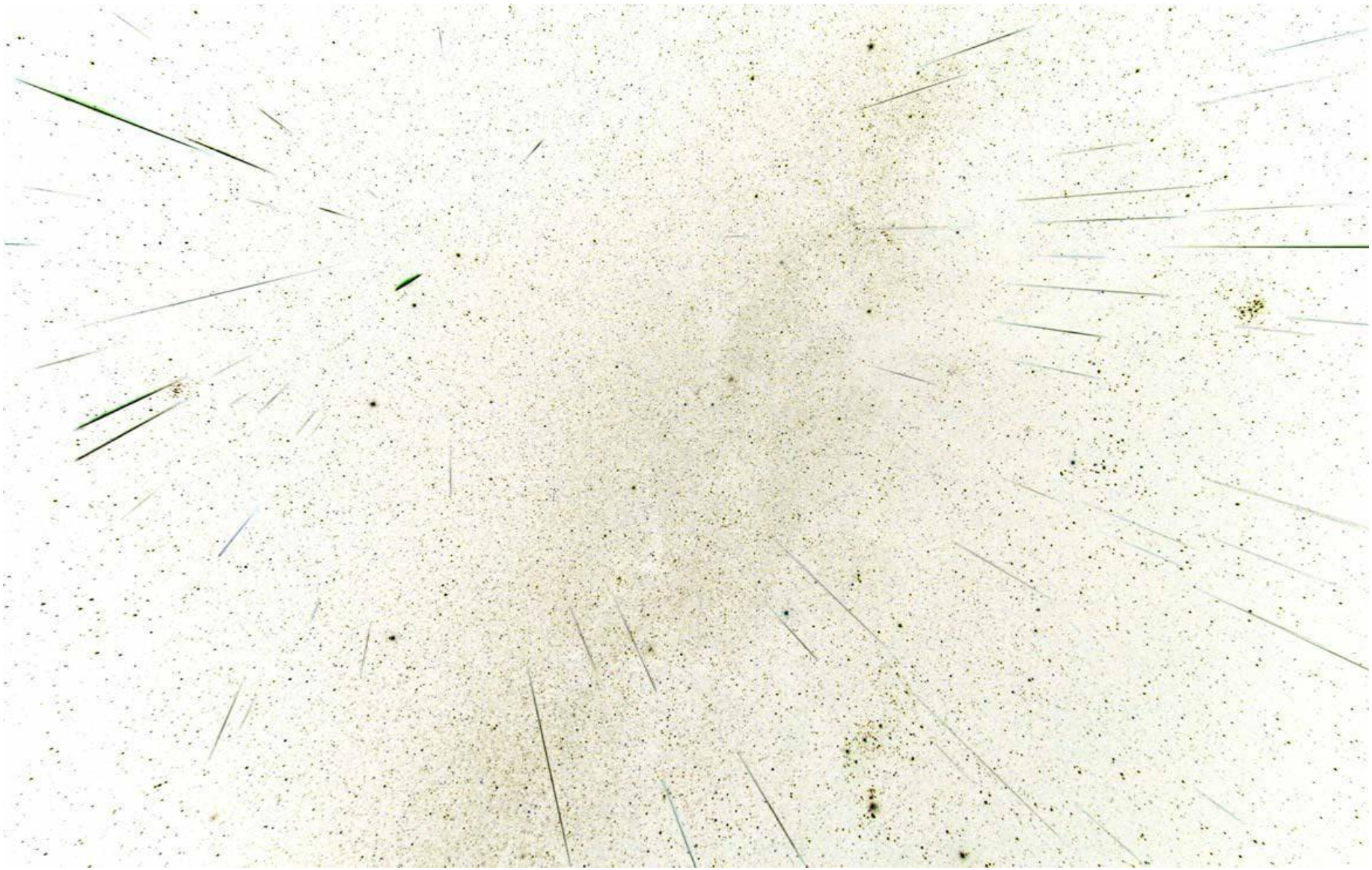


Image description: Meteor shower from the Southern sky in winter in the Northern Hemisphere. Note constellation Orion bottom, just right of center.
http://www.astronomynotes.net/wp-content/uploads/2008/12/geminids_bruenjes_midsize.jpg

ACTIVITY #3: METEOR FLUX

Meteor showers have periods when there is peak in the amount of material burning up in the atmosphere. The amount of meteors observed per hour is called the "**flux**" of the shower. From observations made over many years and mathematical models, we can predict the flux of a meteor shower wherever we want to in the world.

During the period of the meteor shower chosen for you to observe, you will count the number of observed meteors to determine the flux of the shower and compare this to the mathematical model used to predict the flux.

The night that you observe the meteor shower, you will do the following:

1. Situate yourself before hand to determine where some of the key constellations in your piece of the sky. Use a sky chart to assist you.

2. When you start observing the shower, take note of the paths that the observed meteors are taking. Write some of these on your star chart and plot the radiant later on to see if your observations brought you close to the expected radiant.

3. Count and record the number of meteors you see every 10 minutes for the duration of time you are observing the meteors. Then plot the number of meteors observed per 10 minutes on the graph to see if the flux increased over time.

4. Next, determine the hourly flux of the shower from your count and compare this with the predicted flux you determined from the website below :

http://leonid.arc.nasa.gov/estimator.html

What can you conclude from your observations compared to the mathematical model? Are your observations more accurate?

TEACHER'S GUIDE

ABOUT THE CONSTELLATIONS:

The winter sky in New Brunswick has a seasonal cluster of constellations in the Southern sky that are distinct and easily identified. To orient yourself with these constellations, first locate Orion. This constellation is composed of a pattern of stars that is very distinctive, with the four stars outlining his body, and three belt stars with the hanging sword. (The group of stars that make up the sword also contains a nebula that can be seen with binoculars or telescope.)

To the lower left of Orion is the brightest star in the sky, a white-blue star called Sirius. This is the main star of the constellation Canis Major. Moving up and to the left you can see the constellation of Canis Minor, and continuing along the arc you will see two bright stars situated side by side, one red and the other white. These stars are Castor and Pollux, and they constitute the heads of Gemini, the constellation from which the Geminids meteor shower appears to emerge.

Above and to the left of Gemini is the constellation Auriga, and if you continue downward and to right in a descending fashion you will locate the V-shaped constellation of Taurus the Bull. The eye of Taurus is a distinctive red star called Aldebaran. Just above Taurus is star cluster called the Pleiades, or the Seven Sisters.

This oval arrangement of constellations is contained within the Winter Circle, a line that can be drawn through the brightest stars of this group of constellations: Capella, Aldebaran, Rigel, Sirius, Procyon, Pollux and Castor.

CONSIDERATIONS

Ch
oosing the right evening for students will depend on the day of the chosen meteor shower and the conditions of the sky. Table 1 on page 12 provides projected dates for a number of meteor showers and the peak flux days. The Geminid shower (whose radiants originate from the constellation Gemini) is used in the photo example for the students in Activity 2. This shower in particular is well timed for the third week in December. Activities 1 and 2 can be conducted ahead of time, and the last activity left to the selected date. Also, choosing a shower that is observable on weekend evenings will increase the amount of students who will be able to conduct Activity 3.

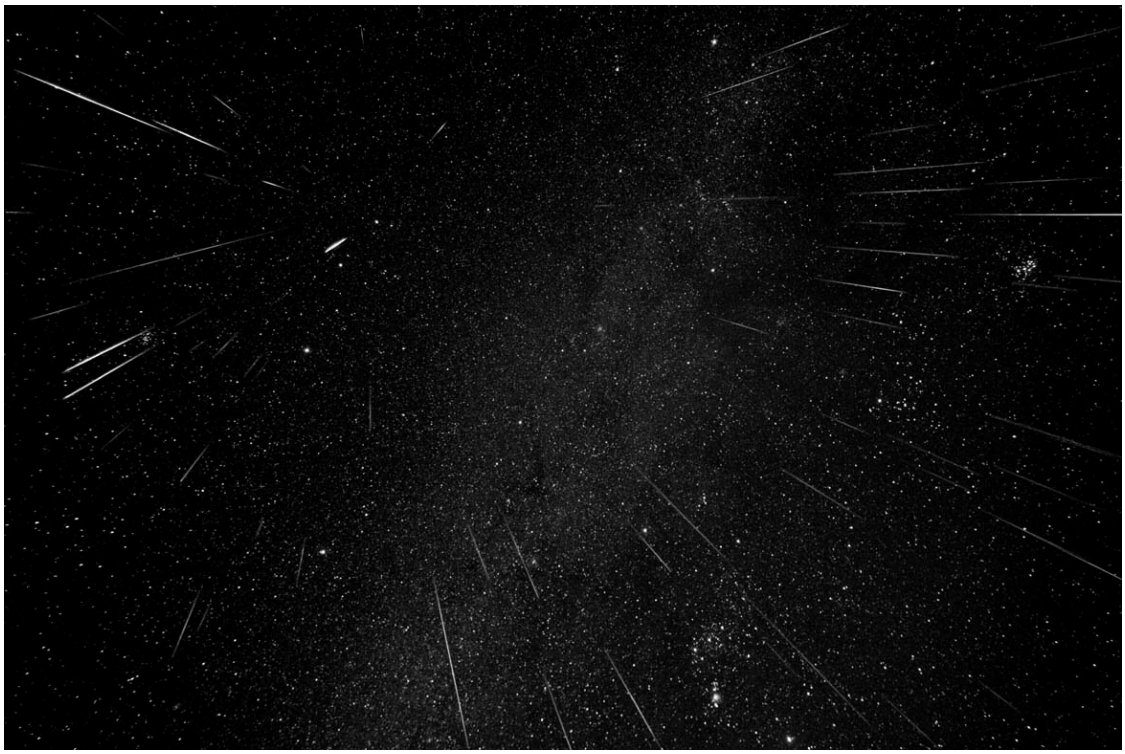
REGARDING THE ACTIVITES:

Activity 1: Finding the constellations

This activity may be best preceded by a video or discussion of the maritime and mythological significance of the constellations. This will peak interest for students to find and trace out the figures they have heard about. Two sets of images have been provided for the students to work with.

Activity 2: Determining Radiants

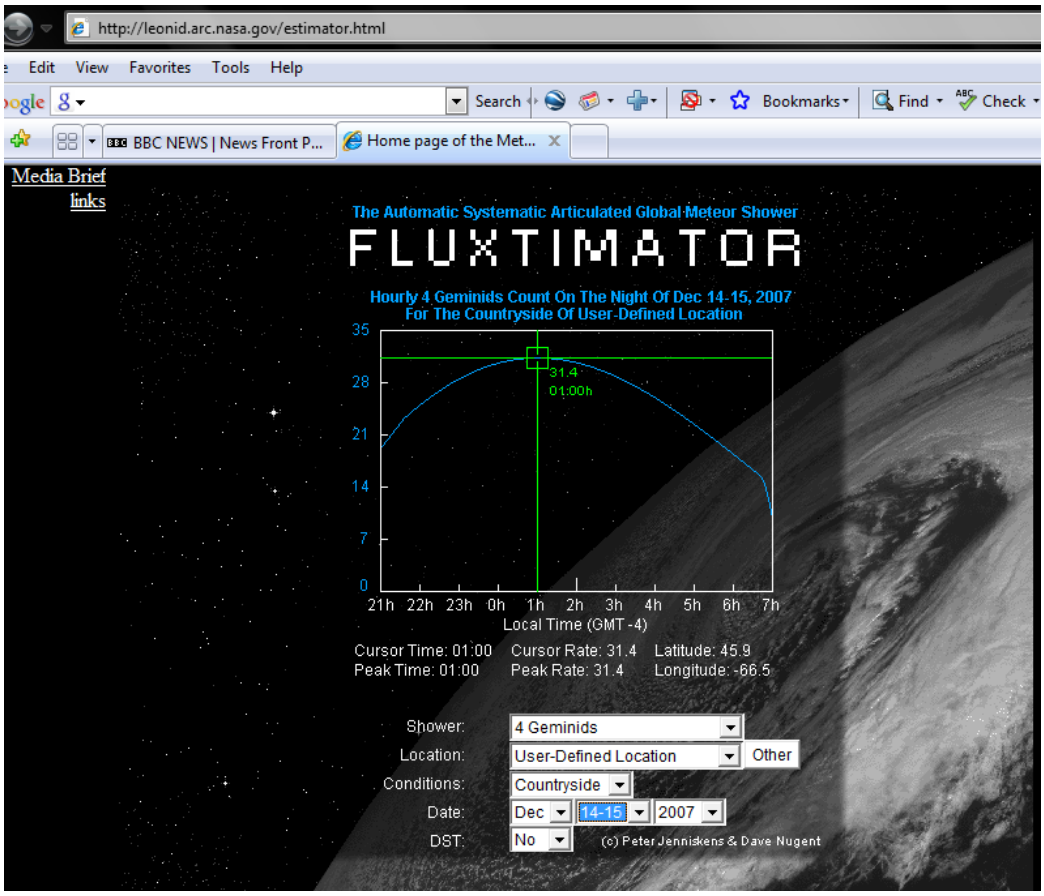
The image provided to students is a colour inverse of the original for ease of photocopying as the original has a black background. The original full colour version is given here for clarification to the students if needed. The image is of a *Geminid* meteor shower in the winter night sky of the northern hemisphere, while looking south. Students should identify the Orion constellation as a land mark and then identify others on the image. They may also draw in the constellations to establish a better visual appreciation of the sky they are looking at. This will help identify Gemini as the radiant for this meteor shower.



Activity 3: Meteor Flux

Projected flux levels for known meteor showers can be found at the NASA site that is hyperlinked below. When you access the site, you will need to change the 1) options for the meteor shower in question, 2) your latitude and longitude, 3) your time zone, 4) if you are in the country or city and5) if you are using daylight savings. The Fluxtimator will graph the projected flux vs. hour. Your students can make similar graphs and compare.

http://leonid.arc.nasa.gov/estimator.html



OPTIONAL ACTIVITIES

1. Video: On the night of the shower, if you video tape a large portion of the sky, you can later show this to your students when discussing their observations.

2. Satellites and the ISS: On the chosen night that students observe their meteor shower, they may also look out for the ISS and satellites in orbit that may be passing overhead at that time. Teachers can determine if this opportunity exists by consulting the website www.heavens-above.com.

2009 Meteor Showers

Table 1: **Meteor Shower Calendar 2009**

Name	Date	Frequency	Origin
Quadrantids	January 3 - 4	Up to 45/Hour	Comet 2003 EH1
Lyrids	April 21 - 22	Up to 30/Hour	C/1861 G1 Thatcher
Lyrids	June 14 - 16	Up to 15/Hour	C/1861 G1 Thatcher
Alpha Capricornids	July 28 - 30	Up to 15/Hour	Unknown
Perseids	August 12 - 13	45+/Hour	109P/Swift-Tuttle
Orionids	October 21 - 22	Up to 30/Hour	Comet 1P/Halley
Leonids	November 17 - 18	30+/Hour	Comet 55P/Tempel-Tuttle
Geminids	December 12 -14	45+/Hour	Comet 3200 Phaethon

http://www.scienceray.com/Astronomy/Spectacular-Meteor-Showers-Due-in-2009.437433