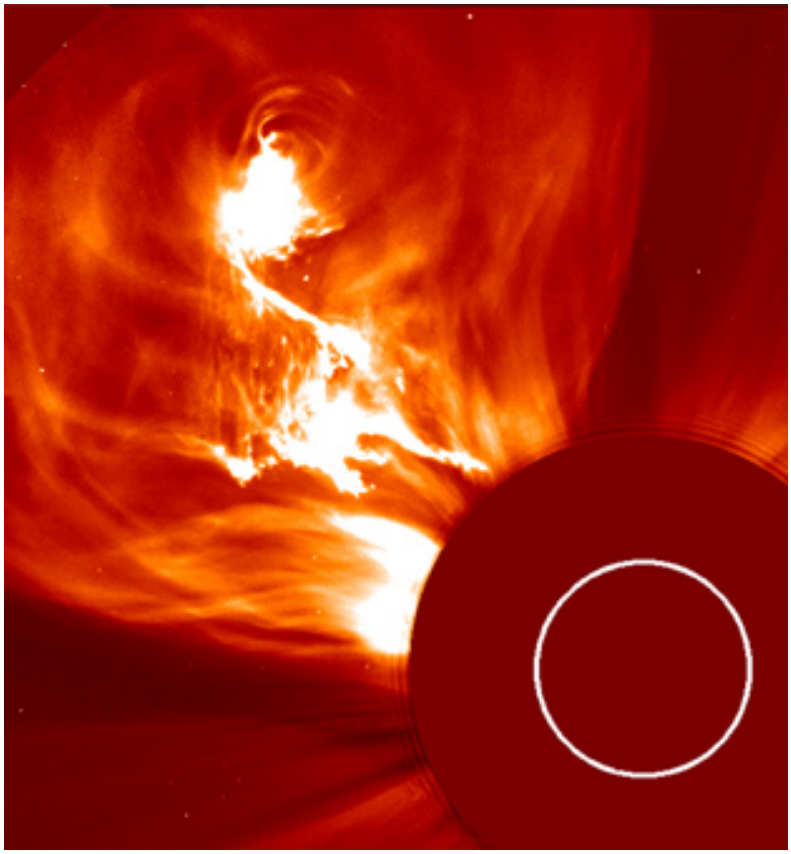
The sun is an active star that produces explosions of matter and energy. The space between the planets is filled with invisible clouds of gas that sometimes collide with Earth. Scientists call them Coronal Mass Ejections. They can travel at millions of miles per hour and carry several billion tons of gas called a plasma. When 'CMEs' collide with Earth, they produce the Northern Lights and magnetic storms.

In this exercise, you will examine one of these 'solar storm' events by examining a timeline of events that it caused.

The picture to the right was taken by the SOHO spacecraft showing a spectacular CME. The white circle is the size of the sun.



Solar Storm Timeline

Day	*Time*	*What Happened*
Tuesday	4:50 PM	Gas eruption on Sun
Thursday	3:36 AM	Plasma storm reaches Earth.
Thursday	5:20 AM	Storm at maximum intensity.
Thursday	5:35 AM	Auroral power at maximum.
Thursday	11:29 AM	Aurora power at minimum.
Thursday	2:45 PM	Space conditions normal

1) How much time passed between the solar gas eruption and its detection near Earth?

2) How long after the plasma storm reached Earth did the aurora reach their maximum power?

3) How long did the storm last near Earth from the time the plasma was detected, to the time when space conditions returned to normal?

Extra for Experts!

If the Earth is 150 million kilometers from the sun, how fast did the storm travel from the Sun in kilometers per hour? How long will the trip to Pluto take is Pluto is 40 times farther away from the sun than Earth?

Goal: Students will interpret a timeline table to extract information about a solar storm using time addition and subtraction skills.

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1) How much time passed between the solar gas eruption and its detection near Earth?

Answer: There are various ways to do this problem. You want to subtract the final time from the initial time so: (Tuesday 4:50 PM) – (Thursday, 3:36 AM) = (Thursday – Tuesday) + (3:36 AM – 4:50 PM) = 48 hrs – (4:50PM – 3:36AM) = 48h – 13h 14m = 34hours and 46minutes.

2) How long after the plasma storm reached Earth did the aurora reach their maximum power?

Answer: Storm arrived at 3:36 AM. Aurora at maximum at 5:35AM. Difference in time is 1 hour and 59 minutes.

3) How long did the storm last near Earth from the time the plasma was detected, to the time when space conditions returned to normal?

Answer: On Thursday, the storm started at 3:36 AM and ended at 2:45 PM, so the storm effects at Earth lasted from 03:36 to 14:45 so the difference is 14:45 – 03:36 = 11 hours and (45-36 =) 9 minutes.

Extra for Experts!

If the Earth is 150 million kilometers from the sun, how fast did the storm travel from the Sun in kilometers per hour? How long will the trip to Pluto take is Pluto is 40 times farther away from the sun than Earth?

Answer: The answer to Problem 1 is 34hours and 46minutes, which in decimal form is 34 + (46/60) = 34.8 hours with rounding. The speed is therefore 150 million km/34.8 hours or 4.3 million km/h. The trip to Pluto would take 40 x 34.8 hours = 1,392 hours or about 58 days. Note, the Space Shuttle is our fastest manned spacecraft and travels at 44,000 km/h so it would take about 58 x (4.3 million/44,000) = 5668 days to make this trip, which equals 15.5 years!!!! Of course, the Space Shuttle will be out of fuel and supplies within a week.