



SPACE PHYSICS

Lecture 13

J. Sahraei

*Physics Department,
Razi University*

<http://www.razi.ac.ir/sahraei>

Meteoroids

- **A meteoroid is a relatively small, rocky body that travels through space.**

Like an asteroid but smaller

Asteroid generally larger than one hundred meters across

Small particle from a comet or asteroid orbiting the Sun.

Meteoroid

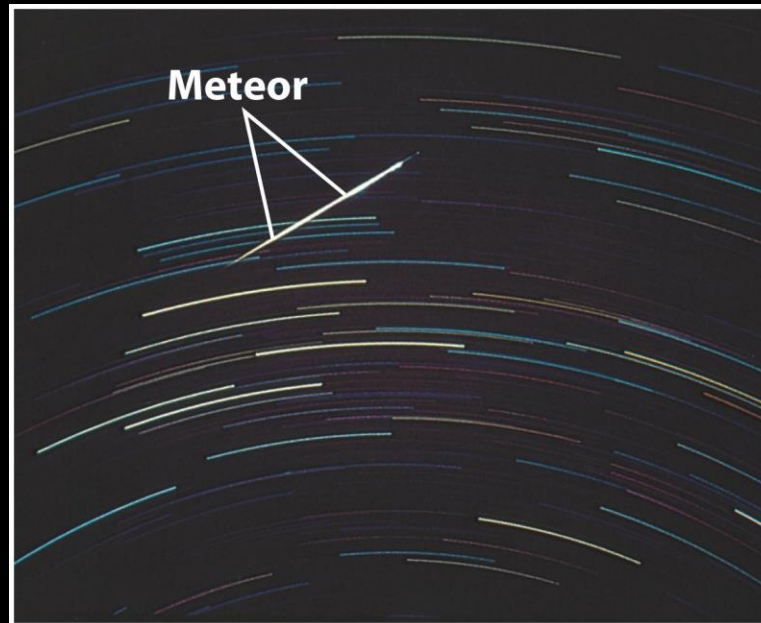


A meteoroid is a chunk of rock, **metal**, or dust in space.

Meteor

The brief flash of light caused by a meteoroid when it enters the Earth's atmosphere, and produces a fiery trail across the night sky

- The glowing is the result of intense heat caused by atmospheric friction



The streak of light created in the sky when an asteroid enters Earth's atmosphere.

A Meteor: “A shooting star”



Shooting stars are not actually stars. These flashes of light across the sky are small bits of rock burning up in the Earth's Atmosphere.

Meteor Showers

Meteor showers do not originate from the asteroid belt.

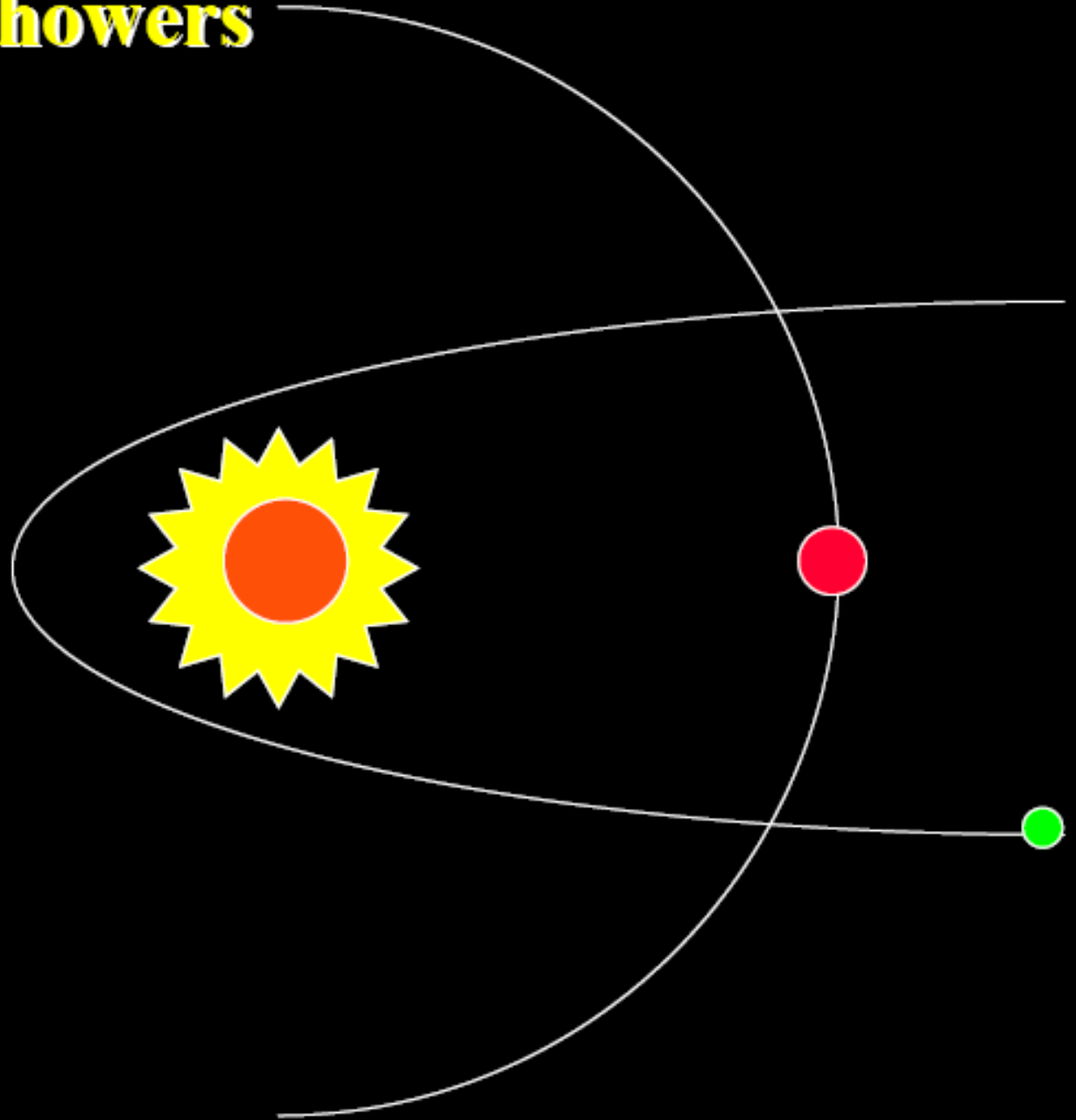
Meteor showers occur when the Earth passes through the orbit of a present or old comet.

When this occurs, the Earth encounters an unusually large amount of particles entering the atmosphere.

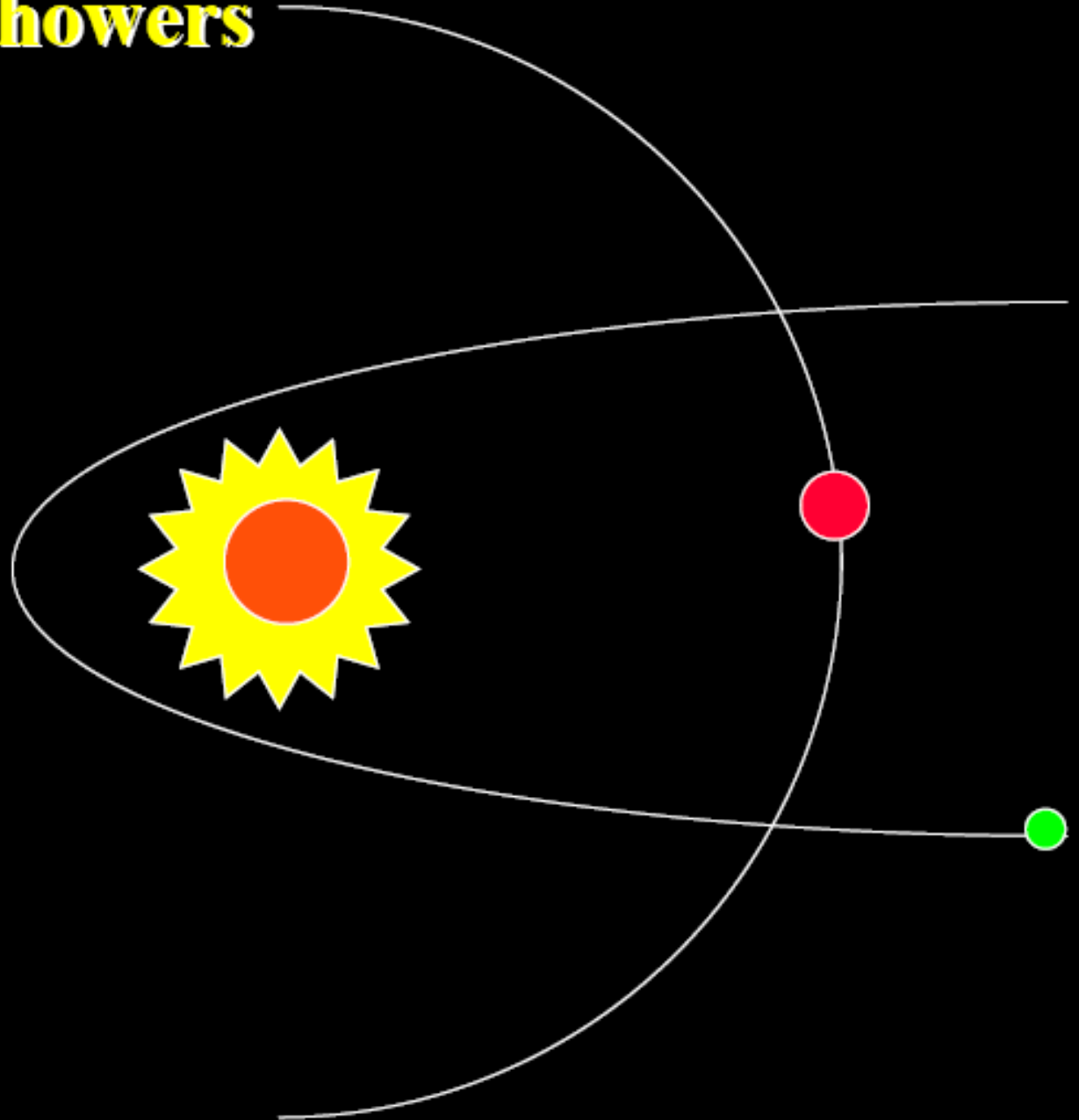
The normal number of meteors is about 6 or 8 per hour, however during a meteor shower this number has reached as much as more than 100,000 per hour.

Lets observe the path of Earth as it passes through a comet orbit

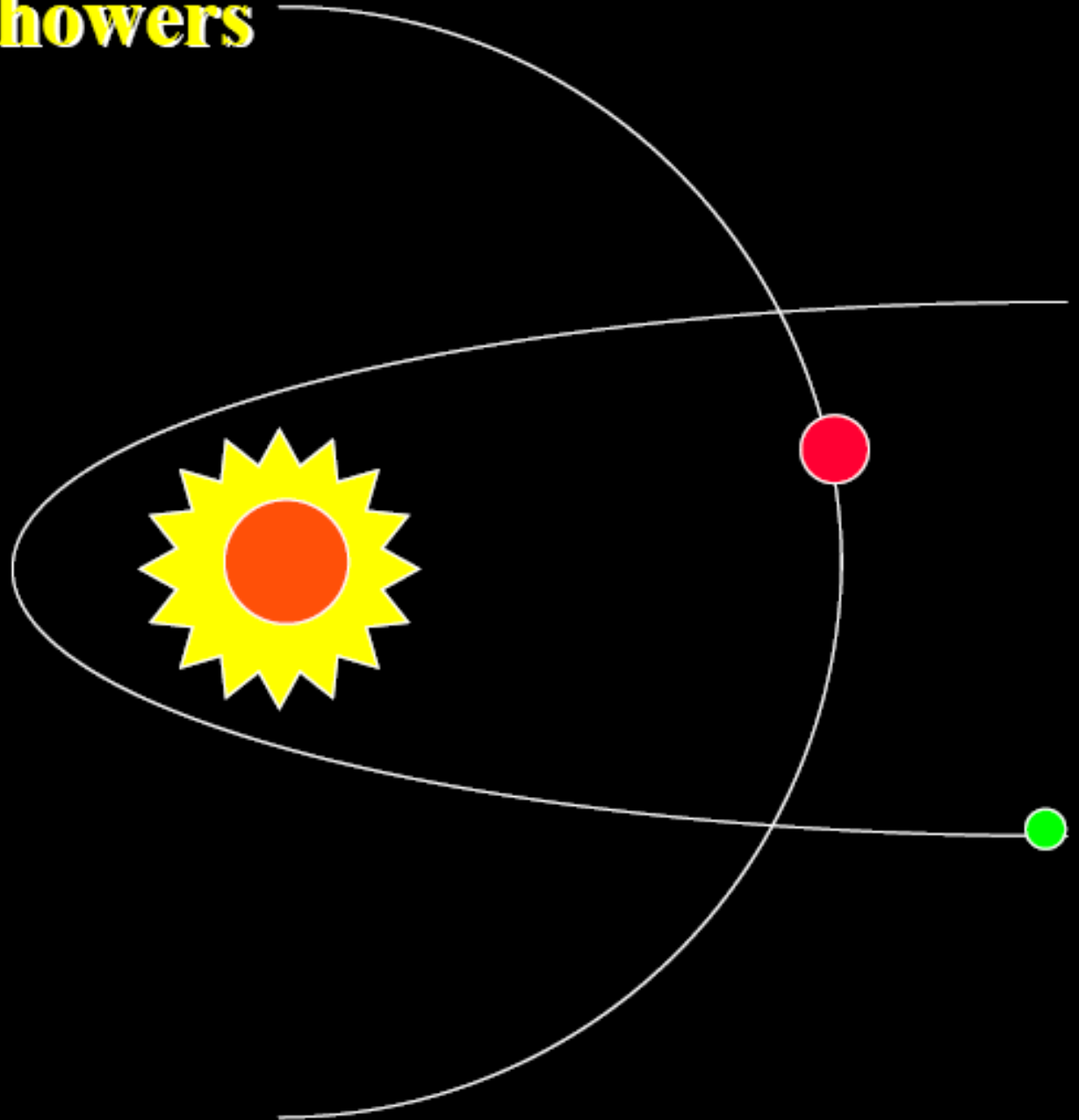
Meteor Showers



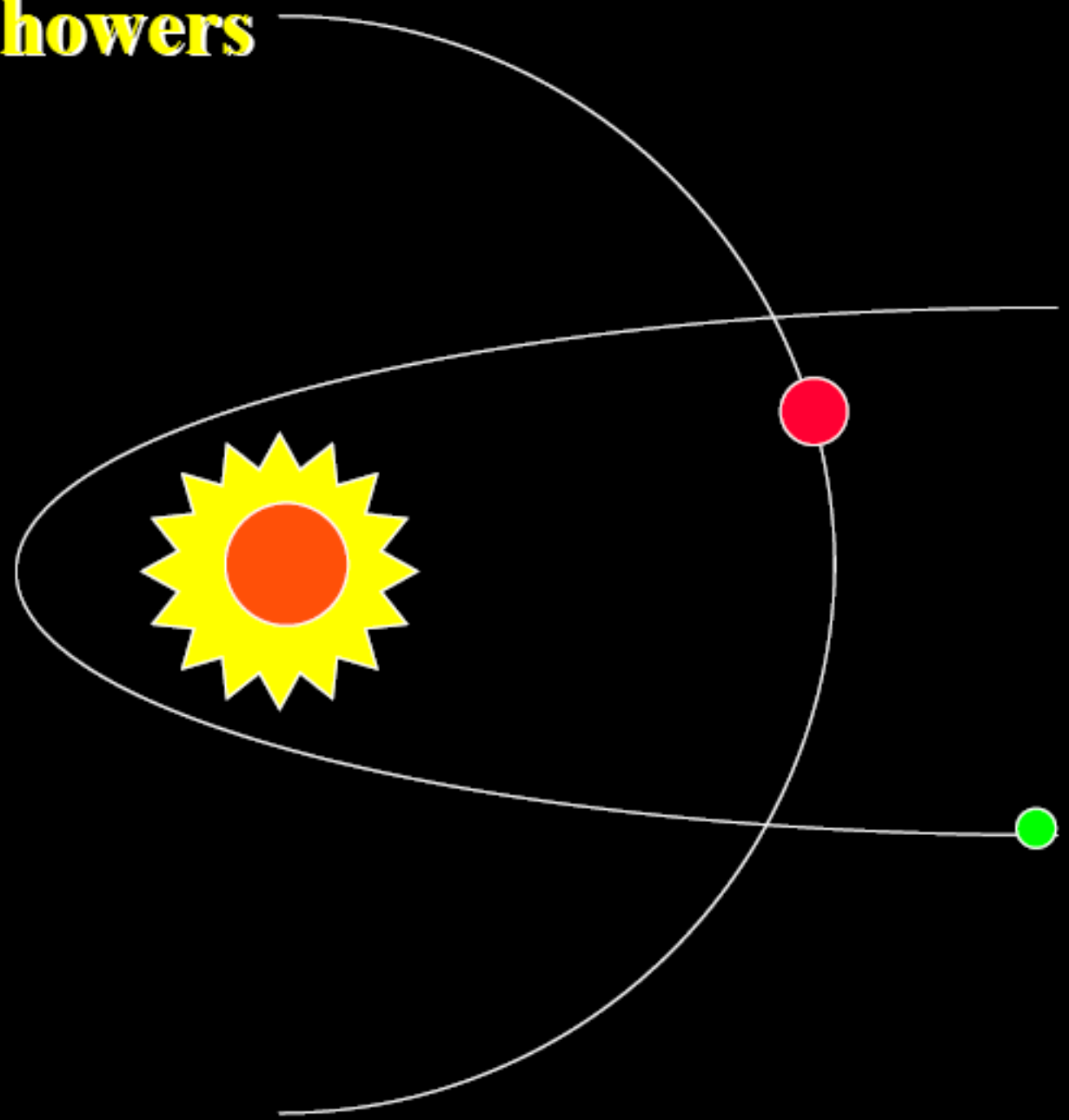
Meteor Showers



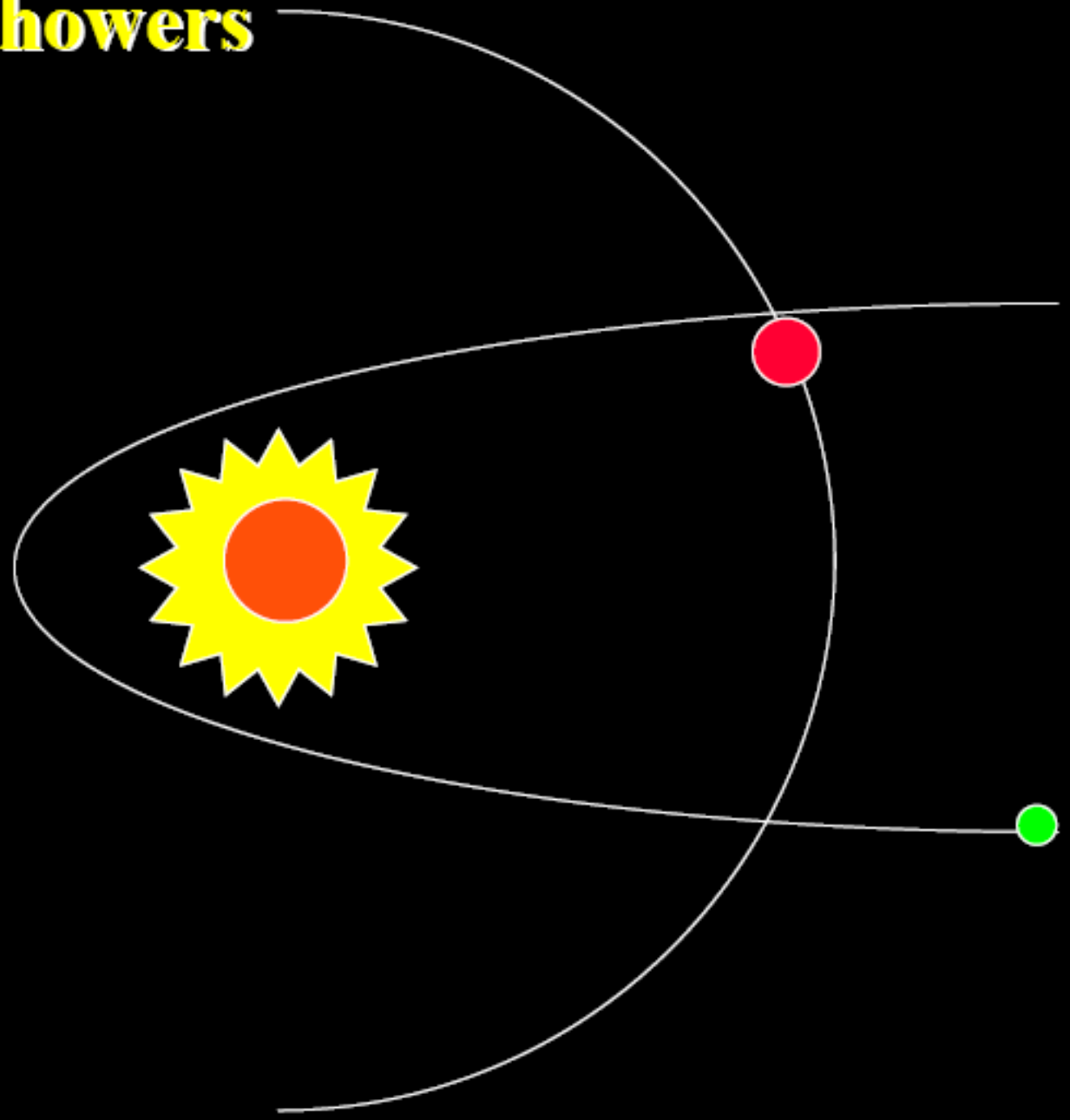
Meteor Showers



Meteor Showers



Meteor Showers



Meteor Showers

When the Earth passes through the Comet's Path --
there can be a meteor shower

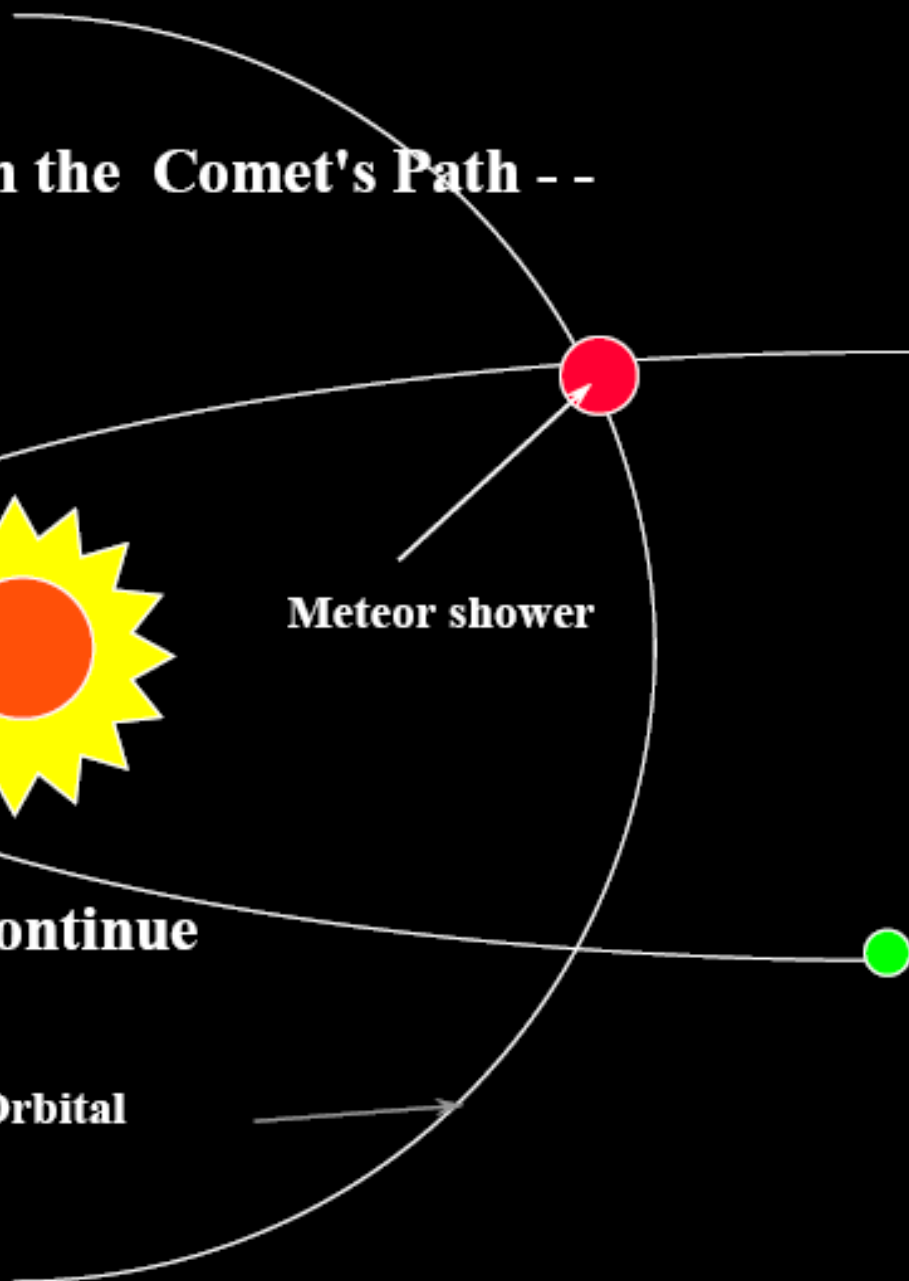
Path of old comet



Meteor shower

Press the mouse or Return to Continue

Earth's Orbital





Why do meteors have a streak of light??

- As they travel through our atmosphere, meteors collide with air molecules that knock away materials and strip electrons from the meteor...
- **When the stripped atoms recapture electrons, light is emitted...**
- The color of the light depends on the temperature and the material being “excited.”



© Brian Larmay c. 2004

Are all meteors the same color??

- The material or element that makes up a meteor is the main factor that determines the color of its glowing trail...
 - Sodium = orange-yellow
 - Iron = yellow
 - Magnesium = blue-green
 - Calcium = violet
 - Silicon = red

Meteorite

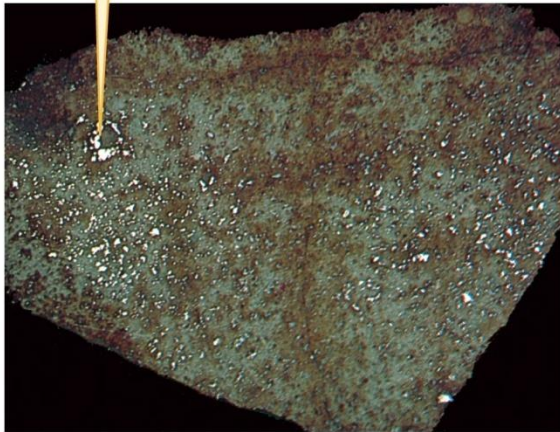
If part of the object survives the fall, the fragment that reaches the Earth's surface is called a meteorite

Solid remains of a meteoroid that survives atmospheric passage and lands on Earth's surface intact.

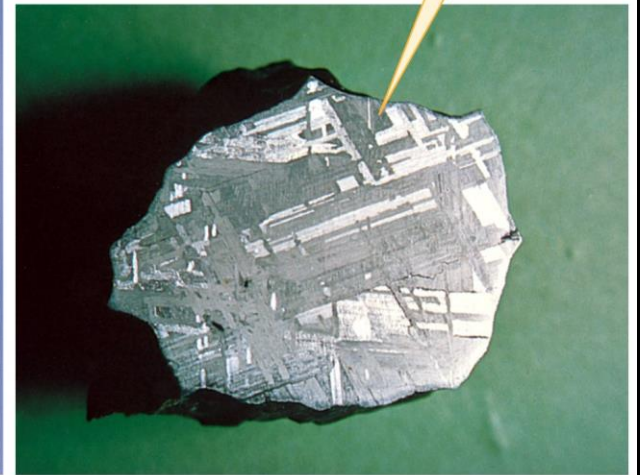
Meteorite

- Meteorites are classified as stones, stony irons, or irons, depending on their composition
- **Stony meteorites account for about 95% of all meteoritic material that falls to the Earth**
- About 300 tons of extraterrestrial matter falls on the Earth each day, mostly in the form of dust.

...but when cut and polished they reveal tiny specks of iron in the rock.



...and when cut and polished, by interlocking crystals in a Widmanstätten pattern.



Meteorite



Meteoroids that survive as they pass through the atmosphere and hit Earth's surface are called **meteorites**.



**There are three major types of meteorites:
stone, iron and stony-iron.**

Barringer Meteor Crater, Arizona



**Crater diameter
1300 m**

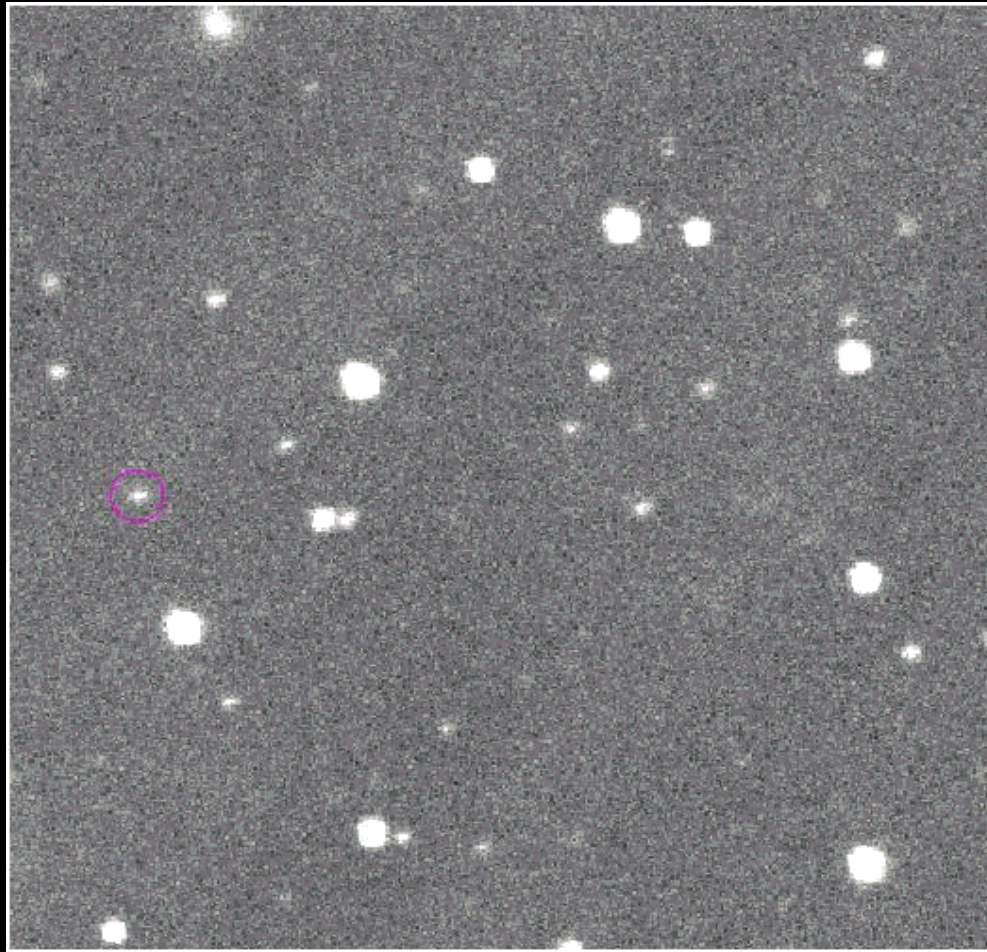
A meteorite can make a hole, or crater, in the ground when it hits it. The larger the meteorite, the bigger the hole.

The story of asteroid 2008 TC3



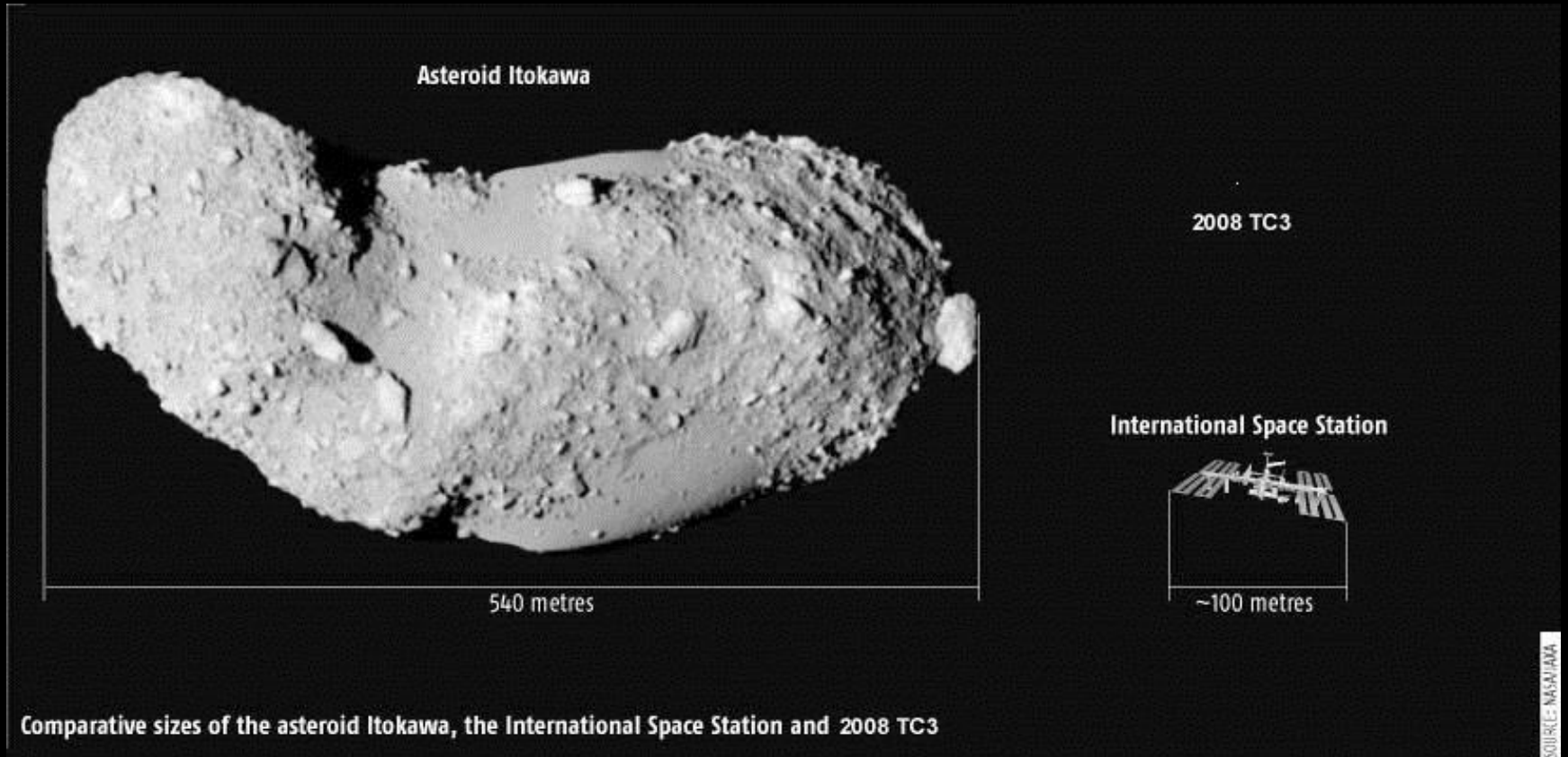
2008 October 6, 6:39 UT

Discovery of a small asteroid, soon called 2008 TC3



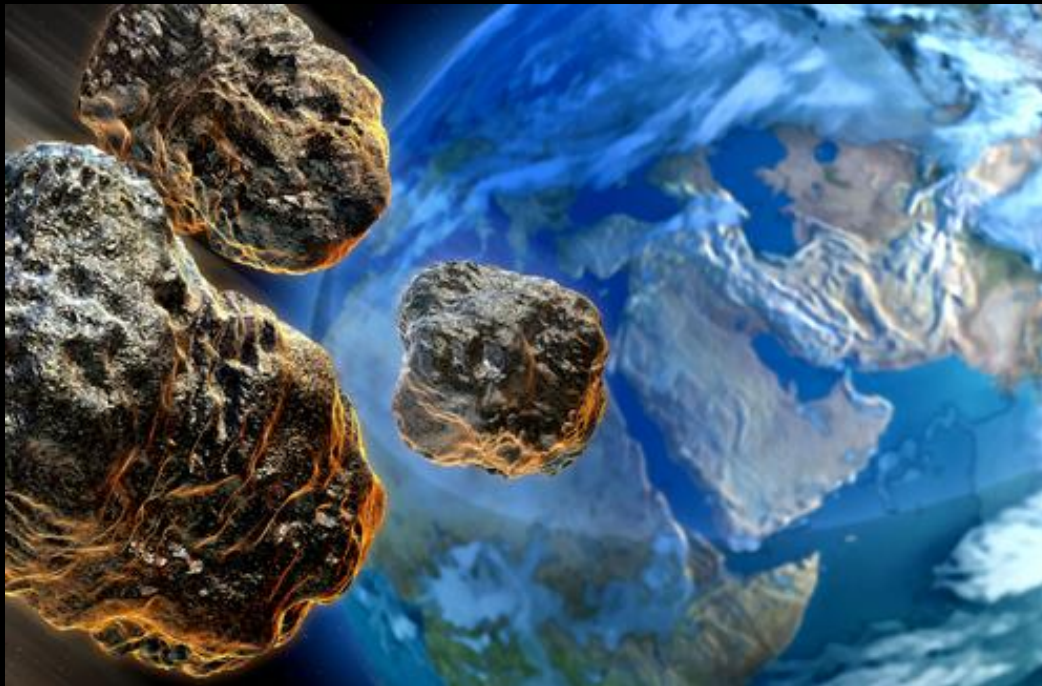
2008 October 6, about 18h UT

Small asteroid = Big meteoroid!

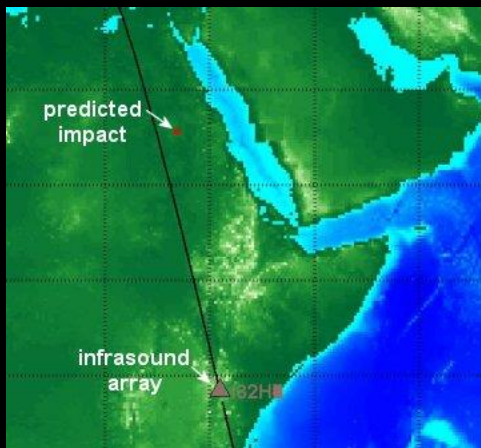
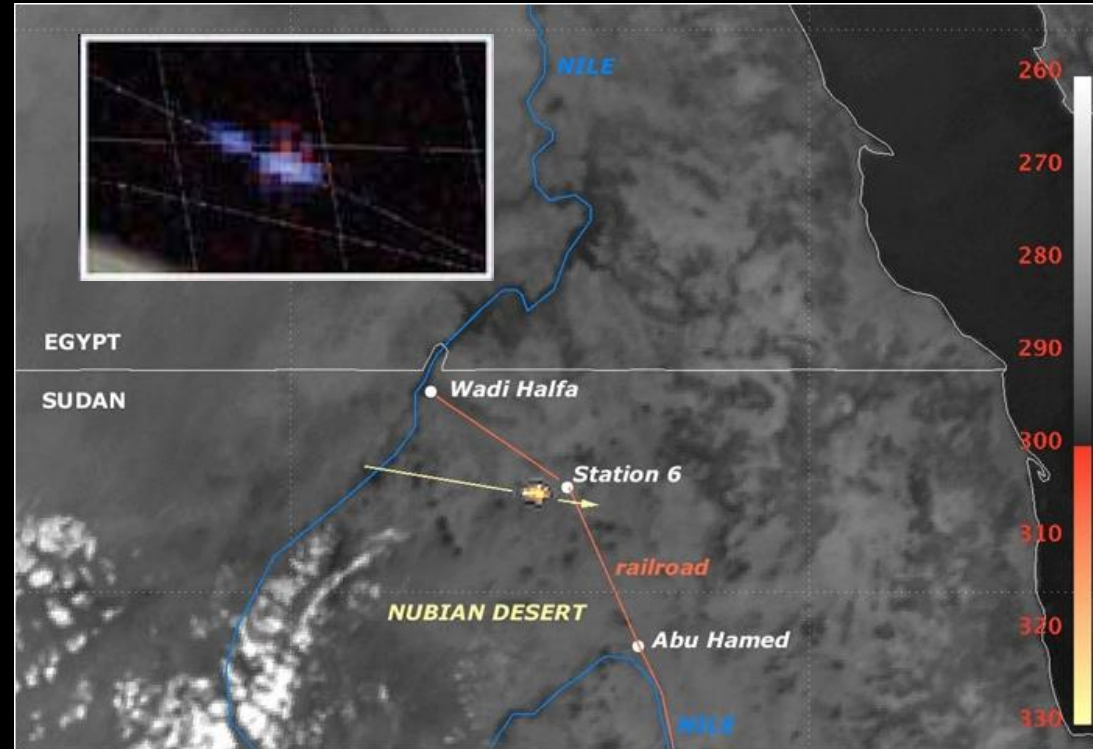


2008 October 6, 14:59 UT
Minor Planet Center: It's coming right at us!

“ Steve Chesley (JPL) reports that atmospheric entry will occur on 2008 Oct 07 0246 UTC over **northern Sudan.**”



Impact point in Nubian Desert of northern Sudan



End of the story...?

37-km explosion:

Apparently, object will not survive passage through the atmosphere, no fragments survived.

Never before have meteorites been recovered from such a high explosion.

But was this really the end of the meteor?

October - early November 2008:

Jenniskens established contact with Dr. Muawia Shaddad (University of Khartoum)

to gather eye witness accounts.

Shaddad forwards images of train taken by cell phone.



Back at “Station 6”: Busload of students from U. of Khartoum!



Start search just down range of explosion



Very end of day #1: They can be found!

“Incredible” - M. H. Shaddad



Mohammed Alameen

2nd day more scruffy black looking meteorites

