Astronomy

From Galileo to Spitzer and Beyond!

Syllabus

Week 1: Introduction. Beginning Astronomy. Naked eye viewing, finding your way in the (Northern hemisphere) sky, some interesting objects.

Week 2: Telescopes, history, types and use. Visual fields, understanding magnification, what sort of telescope to use for what sort of observation. Some minimal math.

Week 3: Telescope setup – how to get the most from your instruments.

Week 4: Basic physics. What are Stars, planets, asteroids, moons, comets, etc. What do we see in the night sky? What do we NOT see? What is our Galaxy?

Week 5: Local viewing – Moon and planets

Week 6: Stars, gas, dust and Pretty Pictures

Week 7: Looking at Deep-Sky Objects – Nebulae and Galaxies

Week 8: Astrophotography

What is Astronomy?

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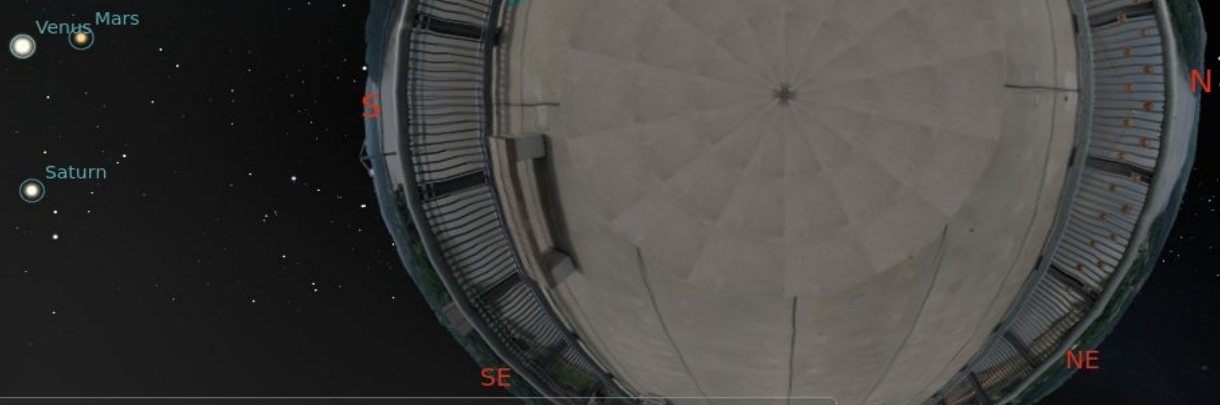

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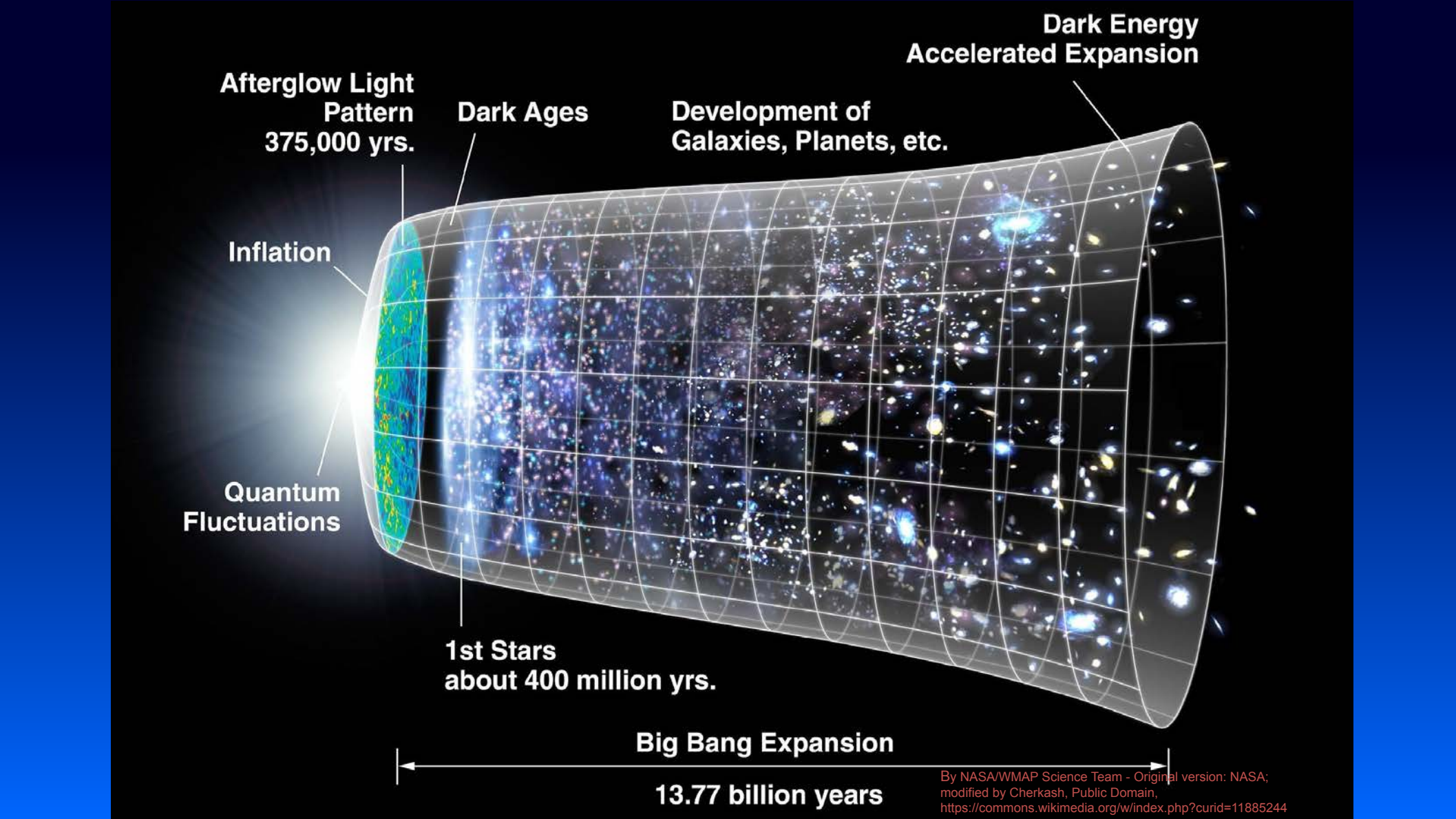
Most of us may think of actual Astronomy as the use of some method of enhancing our Naked Eye view of the sky – the use of Telescopes of various types, all the way up to ways to detect Super Massive Objects colliding.

What is Astronomy?

But what are we actually looking at?

Basic Physics

How did this all start?

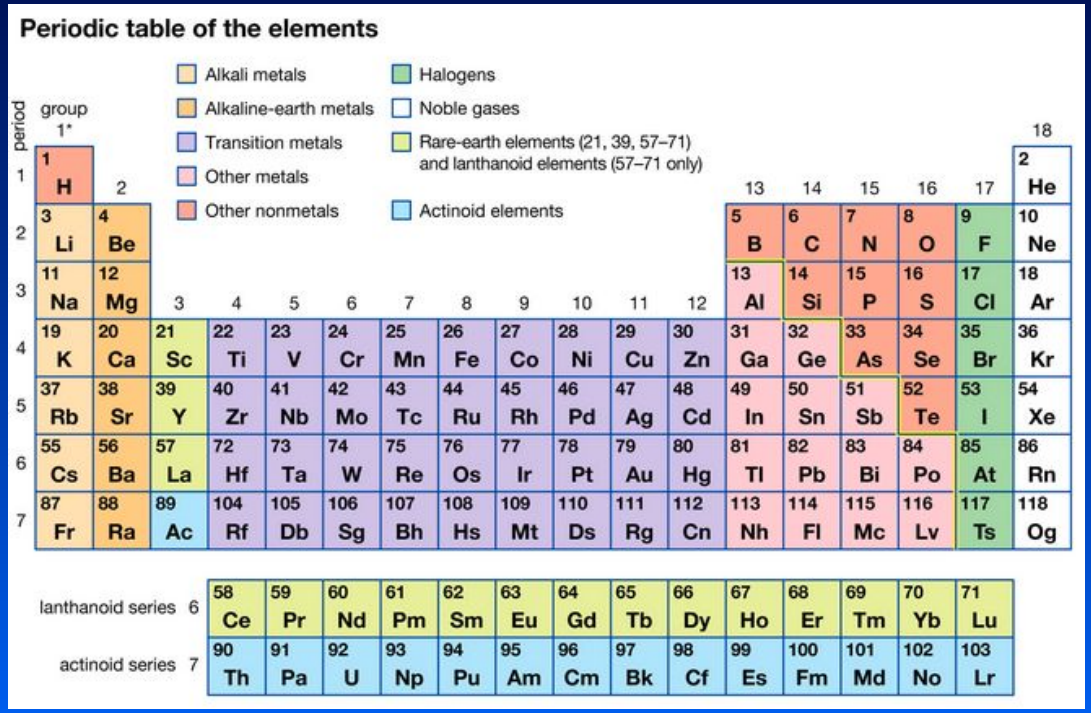


Basic Physics

What are Stars?

The early Universe, once it started to settle down from being born, Hydrogen, and Helium dominate, with a tiny bit (relatively) of Lithium and possibly some beryllium. The Hydrogen collected together – initially by electrostatics, but when large enough, gravitation took over. Galaxies began to collect mass, stars were born.

This is incredibly over-simplified.



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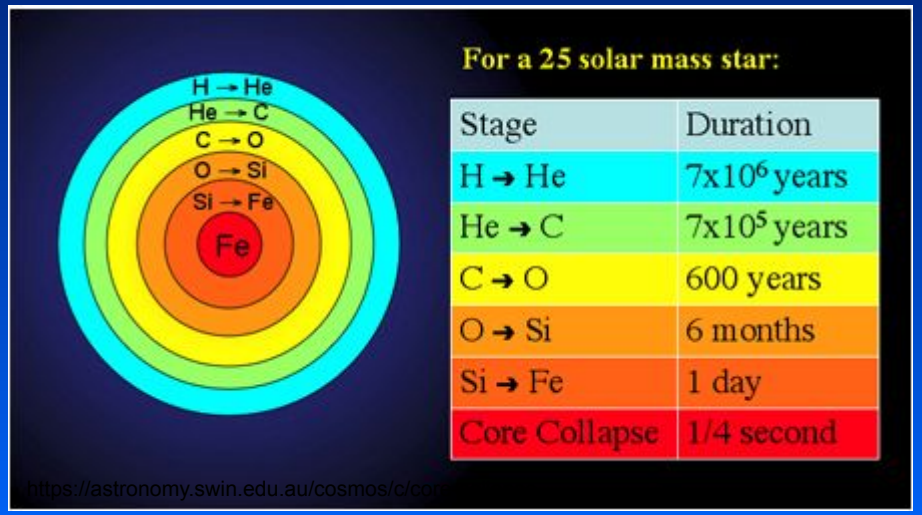
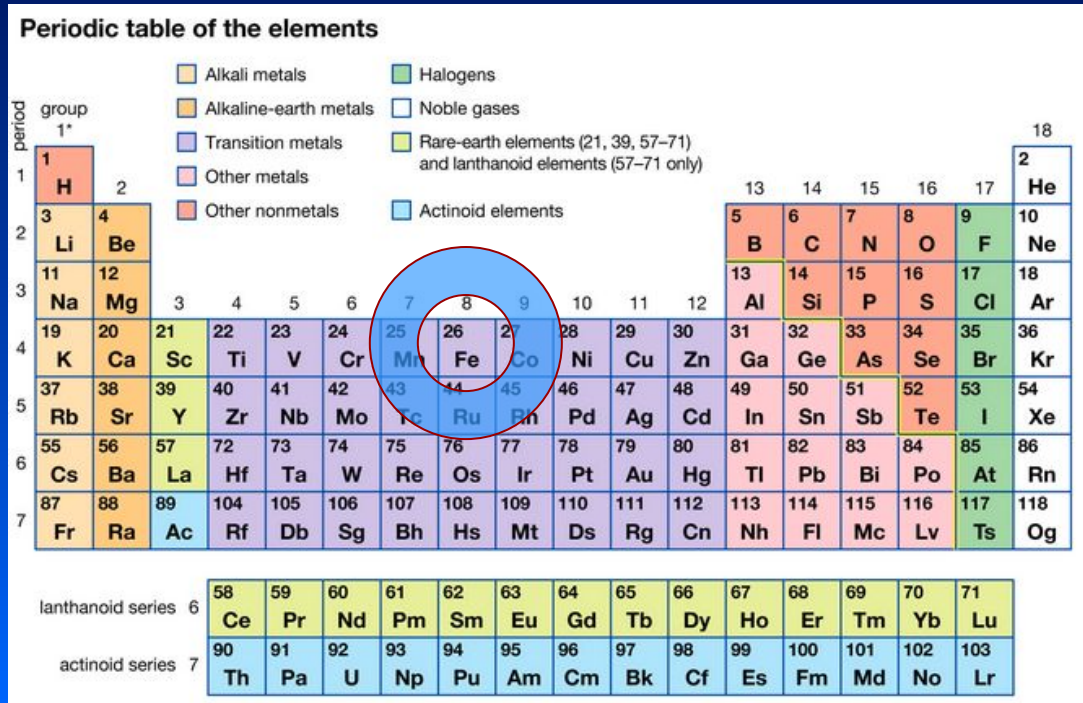
The first stars are huge – 100 times (or more) the mass of our Sun – and thus very short-lived. As stars fuse their Hydrogen, they create heavier and heavier elements – until they start making Iron. Once the first iron molecule is made, a normal star's life is over.



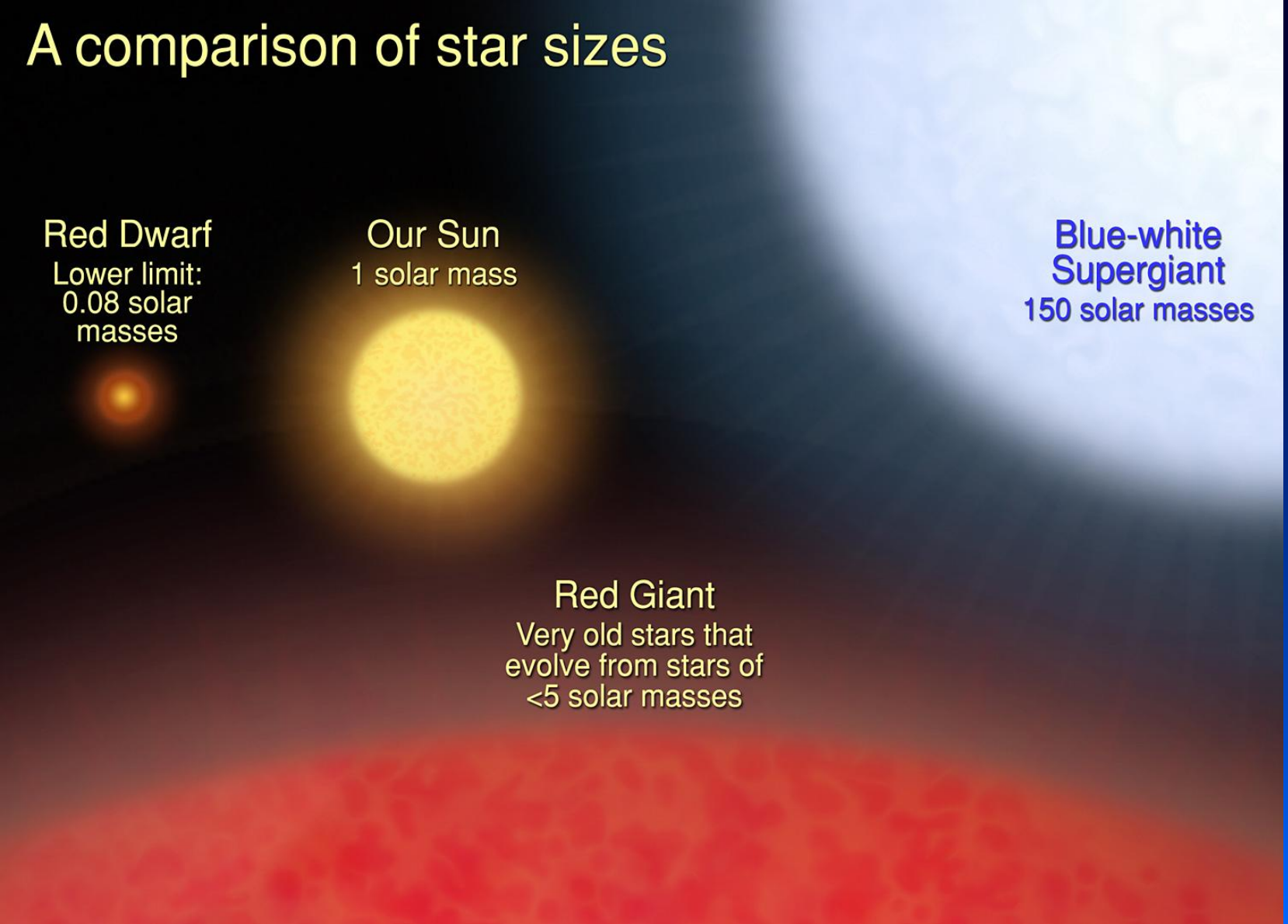
Basic Physics

Stars explode and send out elements, which clump together to eventually form rocky objects, then Planets and sometimes, us. Carl Sagan was right – We ARE Star Stuff. It's where (nearly) everything besides Hydrogen, Helium and maybe a little Lithium and beryllium comes from.



https://www.britannica.com/science/periodic-table

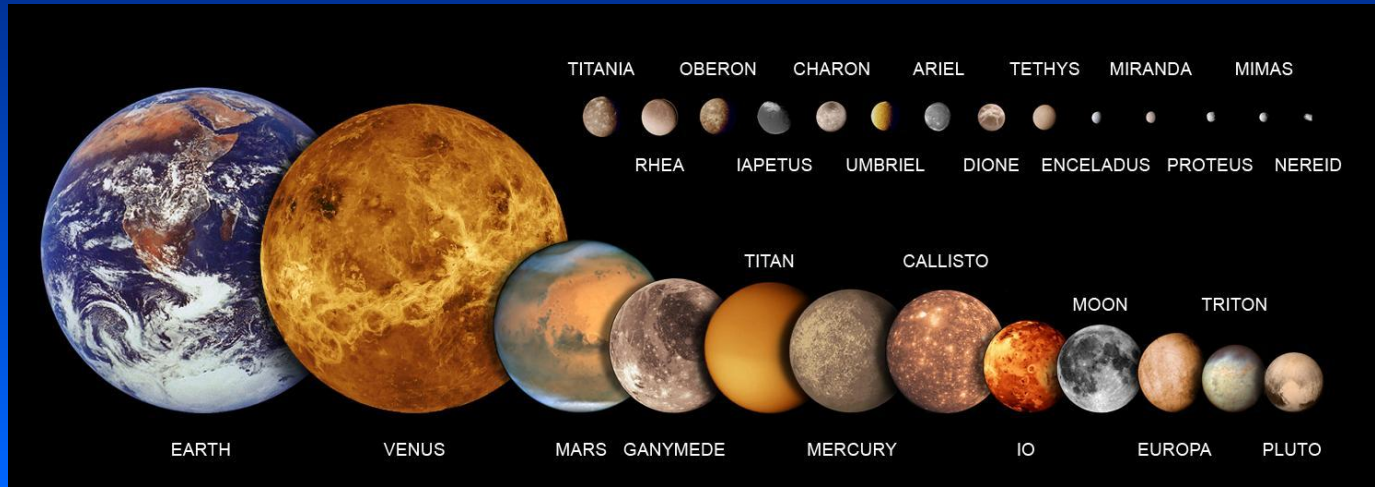
A comparison of star sizes



Size comparison video

Basic Physics

What are Planets?



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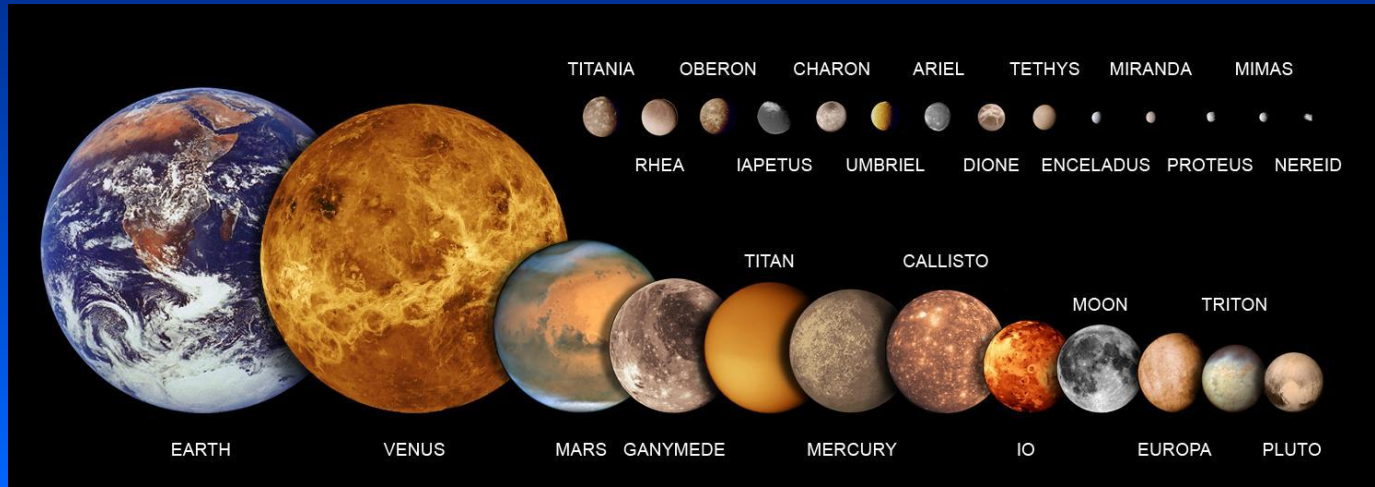

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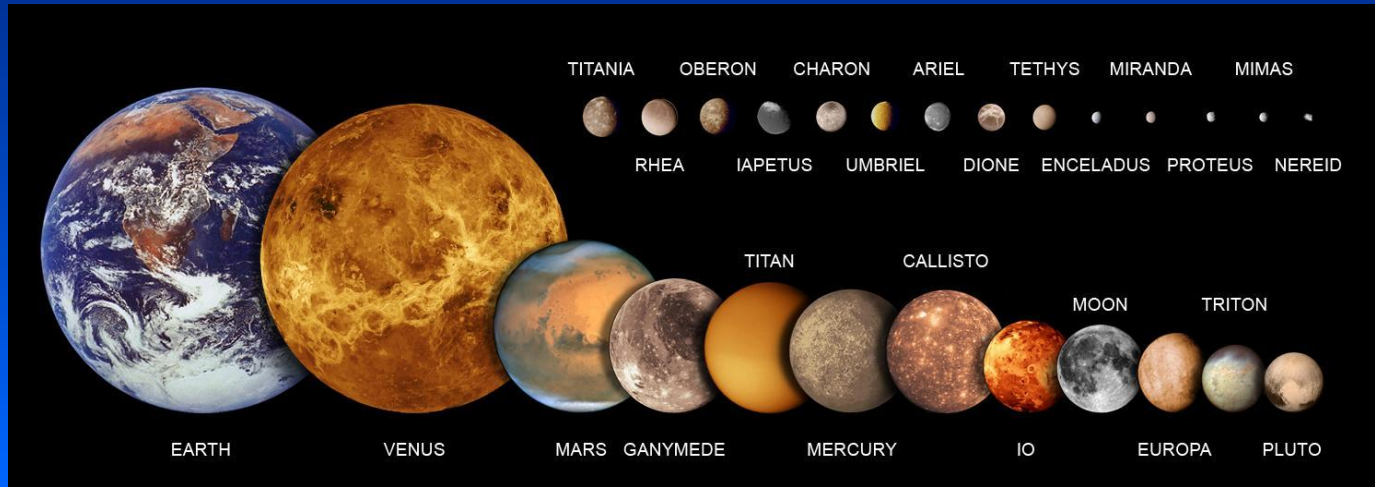

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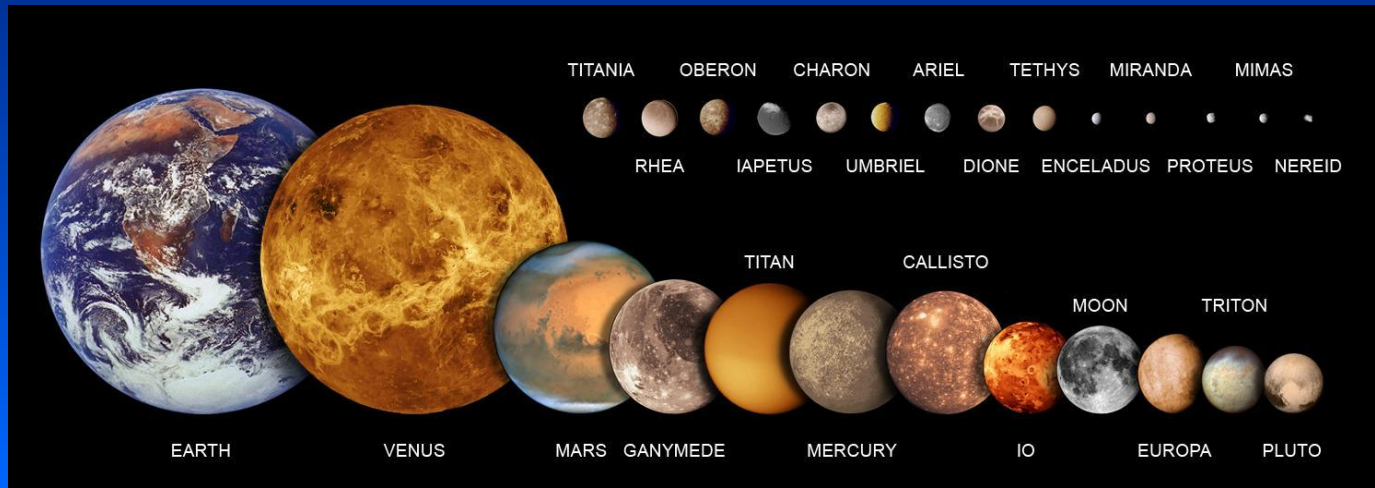

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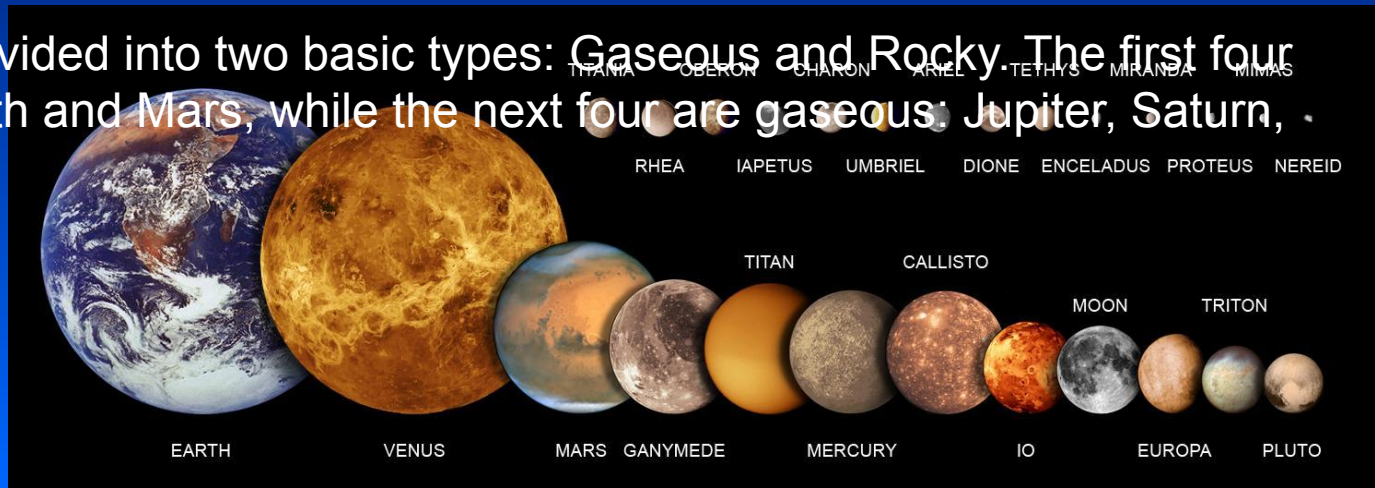
Our Solar System planets are divided into two basic types: Gaseous and Rocky. The first four are Rocky: Mercury, Venus, Earth and Mars, while the next four are gaseous: Jupiter, Saturn, Uranus and Neptune.



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Planets are presumed to form during the collapse of a star-forming nebula. A Protostar forms at the center, surrounded by a rotating disk of gas and dust, or ‘protoplanetary disk’. Dust begins to stick together and accumulates enough mass to attract more mass by gravity, continuing until the mass collapses inward to form a round ball or protoplanet. These may continue to accrete mass until the orbit is cleared of all (or most) matter and the planet is fully formed.

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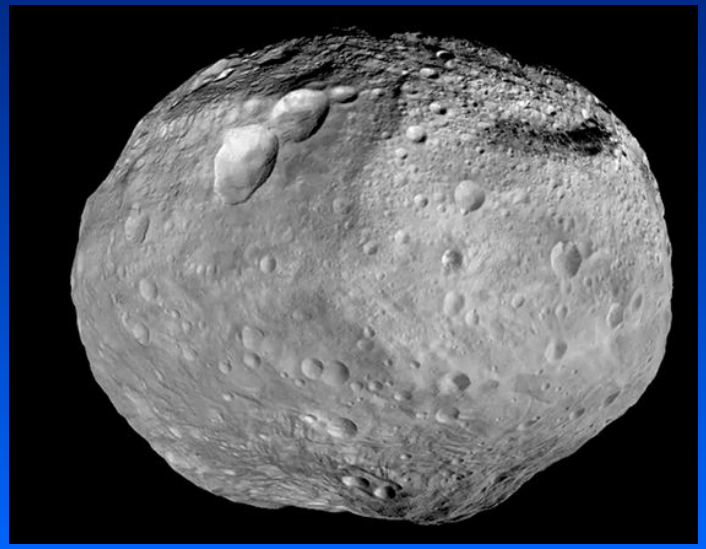
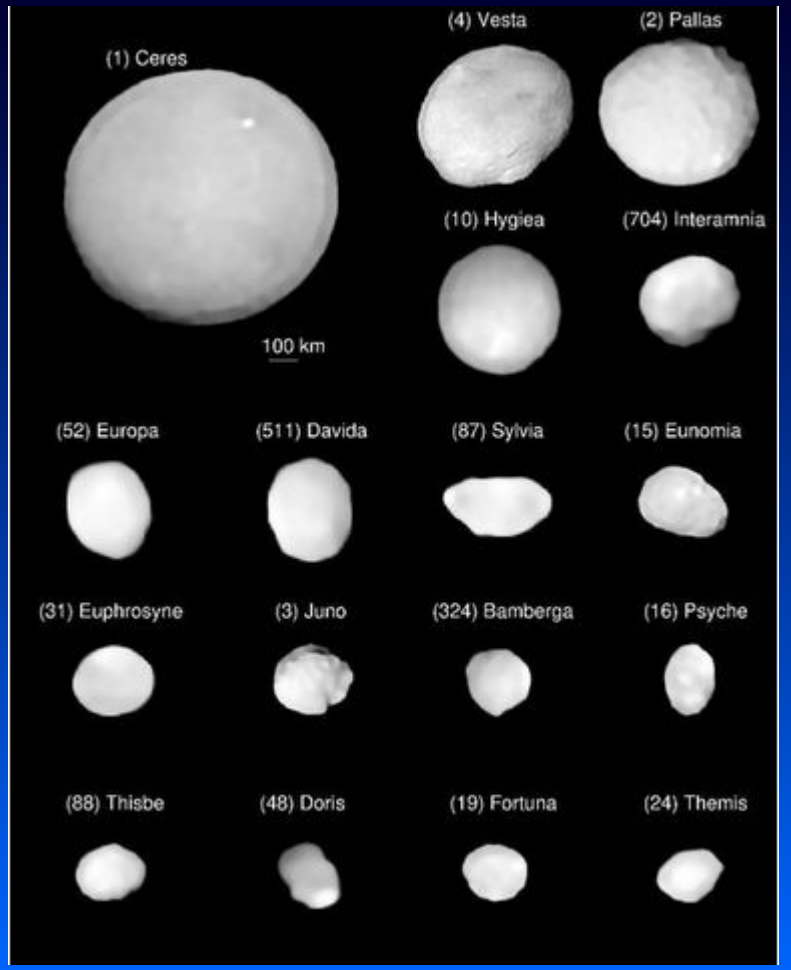
Depending on what was collected by the protoplanet – more gas or more solid material – either a Rocky or Gaseous world will result.

Basic Physics

What about Asteroids?





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When a comet approaches the Sun, it warms and begins to give off dust and gas. These reflect sunlight and create a “coma” or gaseous envelope around the comet body. Solar Radiation may push some of this gas and dust away from the comet body and create the tail we associate with comets.

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Comets may have more than one tail – As the comet moves through space, dust emitted from its surface may be left behind and forms a curved tail that indicates where the comet was. This is a Type II tail, or Dust Tail. At the same time, an Ion Tail, made of gasses, will always point away from the Sun, as it is following the magnetic lines of the Solar Wind. These two tails MAY be oriented in the same direction, but often are not. There may also be an “Anti-tail”

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The word Comet means “Wearing Long Hair” or “Long-Haired Star”

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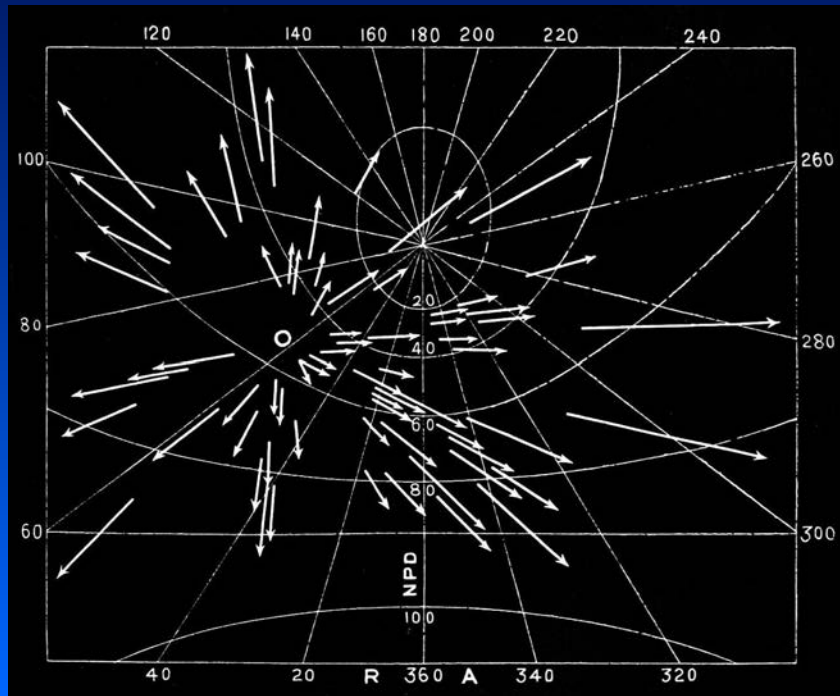
Occasionally, a comet (or asteroid) may cross the orbital path of the Earth. When this happens, dust or other material is left behind to wait for Earth to intersect it. When it does, we may have a “meteor shower” – which is nothing more than tiny grains of dust hitting our atmosphere at great speed and leaving a lovely trail of bright light.

Meteor showers are commonly identified by their “radiant” – or the direction they appear to be coming from. The Orionids, for example, appear to originate from the constellation Orion. This does not mean that all the meteors emanate from Orion, but that if you draw a line backward along the path of the meteor to the point where they all intersect, that location is somewhere near or in the constellation or bright star for which the shower is named.



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Basic Physics

Comet or Asteroid?

While we are on comets and talking about meteor showers, an object (dust, rock, other bit of cosmic debris) that is outside of Earth's atmosphere is referred to as a Meteroid. When that object hits the atmosphere, it is called a Meteor, and when it hits Earth, it is called a Meteorite – the '-ite' suffix being common to rocky minerals on Earth.

The Quadrantid and Geminid meteor showers are among those assumed to be from material deposited from asteroid, rather than comet, passes. These may produce more intense showers or storms due to the more substantial material left behind by the objects that left the material.

Image is of the Geminids photographed in 2013.

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A few exceptions may exist. Our own Moon is thought to have formed when a protoplanet about the size of Mars collided with proto-Earth and knocked off a bit of mass. This molten planetary mass eventually coalesced into the Moon. Charon (around Pluto) is thought to have formed similarly. The two moons of Mars are believed to be captured asteroids, though a recent analysis indicates they may be bits left over from a larger moon that was hit and destroyed.

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Our own personal Moon is unique in that it's size appears to us on Earth as nearly exactly the same angular size as the Sun, and this gives us the unique event of Solar Eclipse events!

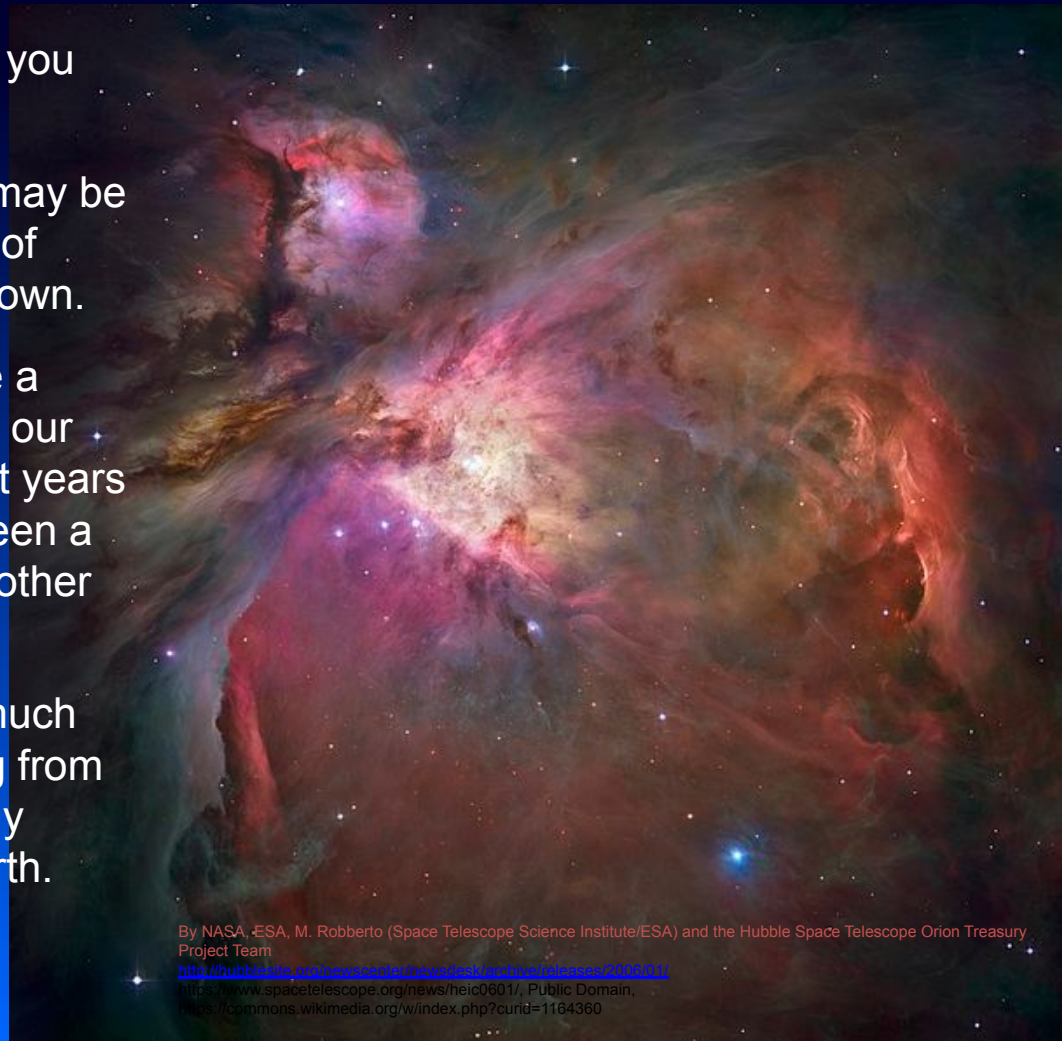
What do we see in the night sky?

Naked Eye Astronomy gives us quite a bit more than you may think.

When most of us look up, we see stars. Some of us may be able to discern our visible planets from the stars and of course, when the Moon is present, it's face is well known.

But what else is up there? Did you know you can see a gaseous nebula? Did you know you can see not only our own galaxy, but another entire Galaxy 2.5 million light years away? Do you know how to spot the difference between a high-flying jet and the International Space Station or other orbiting man-made satellites?

Of course, with optical instruments. All of these are much more visible, but when you look at the sword hanging from Orion's Belt, you are seeing not just stars, but the only visible nebula we can see without instruments on Earth.



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Thank You!