The Heavens Declare the Glory of God…
The Law of the Lord is Perfect, Restoring the Soul
Psalm 19

The Universe
IfMyPeople.us

Slide 2

The Universe
Putting Back the Awe of God's Creation
A Six-Part Series

1. Building Blocks
2. Goldilocks
3. To the Moon!
4. Our Neighborhood
5. Stars
6. Galaxies

Slide 3

Be Like Newton:

- Come With a Curious Mind
- "Have You Ever Asked Yourself…"
- Aim: The Glory of God Not the Spotlight of Foolishness

Curious Mind: Don't Take things for granted.

Have You Ever: Be child like in asking how and why etc.

Aim: Great are the works of the LORD; They are studied by all who delight in them. — Psalm 111:2 Tonight (and this series) is for worship.

Slide 4

Last Time: The Stars – A Display of Master Design

The Vast Power of Stars
The Variety of Stars
God's Glory in the Stars
Our Sun: Power Under Control

Vast Power – The power and variety of stars is staggering. The sun is a wonderful example of our Savior: Strength under control. Psalm 19 holds the key.

Variety – The variety of stars, like people, plants and animals reflects God's love of beauty and great variety.

God's Glory – This variety and power displays yet another facet of God's great glory and our wonder & astonishment leading to worship of our magnificent Creator.

Our Sun – Our star, the sun reflects some of the great power under control of Jesus Himself.

Slide 5

The Big Idea

The Universe, Vast and Awesome Reflects God's Vast Majesty and Awesomeness

Slide 6

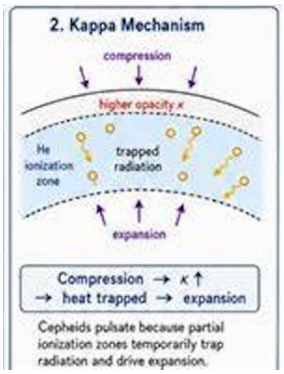
The Universe: Overwhelming Awesomeness

The Awe of Galaxies
The Awe of Nebulae
The Awe of Other Wonders
The Awesome Expanse

Slide 7

Cepheid Variable - Revisited

- Predictable Brightness
- Very Bright
- Measure Distance
- K Mechanism



"The pulsation mechanism in Cepheids is rooted in the so-called **κ-mechanism** (kappa mechanism), where the opacity (symbol κ) of partially ionized helium layers in the star changes with local conditions. In the region where helium transitions between singly ionized He I and doubly ionized He II, opacity increases with temperature and pressure in such a way that radiation is temporarily trapped. This added energy inflates the outer layers, lowering the density and temperature, which then reduces the opacity and allows energy to escape. The outer envelope contracts again, restarting the cycle."[1]

[1] https://www.opticalmechanics.com/cepheid-variable-stars-the-universes-yardsticks/#how-cepheids-pulse

Slide 8

Globular Clusters – “Globular clusters are tightly-packed spherical agglomerations of stars and are thought to be some of the oldest objects in the Universe. ‘Globulars’, as they are sometimes called, are both beautiful and enigmatic star clusters: they can make you slow down to ponder the history and future of the cosmos.

Globular clusters appear to be found in the haloes of most large **galaxies**, with numbers generally increasing with the size of the galaxy.” [1]

“Globular clusters are beautiful, spherically symmetric star clusters resembling celestial snow globes. Star density is greatest near the cluster centre, and this density drops off with increasing distance from the cluster centre. Approximately 150 globular clusters orbit our own Milky Way galaxy, including the Messier 80 globular cluster in the constellation Scorpius.” [2]

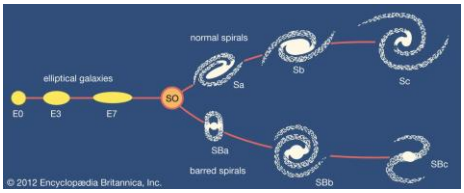
Pictured: M35 in Pegasus.

[1] https://www.skyatnightmagazine.com/astrophotography/stars/star-clusters/globular-clusters
[2] https://creation.com/en/articles/central-rotation-in-globular-clusters

Slide 9

Galaxy Types

- Elliptical (E)
- Spiral (S)
  - Normal (a,b,c)
  - Barred (sa,sb,sc)
- Irregular



Hubble’s classification system:
Ellipticals – “These systems exhibit certain characteristic properties. They have complete rotational symmetry; i.e., they are figures of revolution with two equal principal axes. They have a third smaller axis that is the presumed axis of rotation. Ellipticals are red in colour, and their spectra indicate that their light comes mostly from old stars, especially evolved red giants.” [1]

Spirals – “Spirals are characterized by circular symmetry, a bright nucleus surrounded by a thin outer disk, and a superimposed spiral structure. They are divided into two parallel classes: normal spirals and barred spirals. The normal spirals have arms that emanate from the nucleus, while barred spirals have a bright linear feature called a bar that straddles the nucleus, with the arms unwinding from the ends of the bar.” [1]

B – “**Irregulars** – “Most representatives of this class consist of grainy, highly irregular assemblages of luminous areas. They have neither noticeable symmetry nor an obvious central nucleus, and they are generally bluer in colour than are the arms and disks of spiral galaxies.” [1]

Irregular galaxies have unusual shapes, like toothpicks, rings, or even little groupings of stars. They range from dwarf irregular galaxies with 100 million times the Sun’s mass to large ones weighing 10 billion solar masses.

Astronomers think these galaxies’ odd shapes are sometimes the result of interactions with others. For example, one spiral galaxy passing another with a stronger gravitational pull could lose some of its material, become distorted, and morph into a new shape. [2]

[1] https://www.britannica.com/science/galaxy/Types-of-galaxies
[2] https://science.nasa.gov/universe/galaxies/types/#irregular-galaxies

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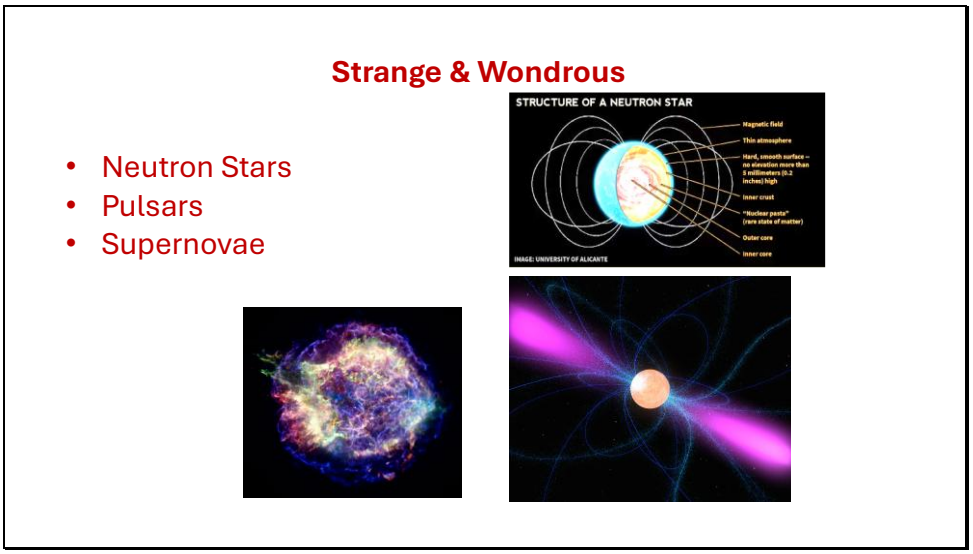


Neutron Stars – “When a star bigger and more massive than our Sun runs out of fuel at the end of its life, its core collapses while the outer layers are blown off in a supernova explosion. What is left behind depends on the mass of the original star. If it’s roughly 7 to 19 times the mass of our Sun, we are left with a neutron star. If it started with more than 20 times the mass of our Sun, it becomes a black hole.

While all known neutron stars have magnetic fields billions and trillions of times stronger than Earth’s, a type of neutron star known as a magnetar can have a magnetic field another thousand times stronger. These intense magnetic forces can cause starquakes on the surface of a magnetar, rupturing the star’s crust and producing brilliant flashes of gamma rays so powerful that they have been known to travel thousands of light-years across our Milky Way galaxy, causing measurable changes to Earth’s upper atmosphere.” [1]

Pulsars – “Some neutron stars, called pulsars, emit streams of light that we see as flashes because the beams of light sweep in and out of our vision as the star rotates. The fastest known pulsar, named PSR J1748-2446ad, spins 43,000 times every minute. That’s twice as fast as the typical household blender! Over weeks, months or longer, pulsars pulse with more accuracy than an atomic clock, which excites astronomers about the possible applications of measuring the timing of these pulses. [1]

Supernovae – “A supernova is what happens when a star has reached the end of its life and explodes in a brilliant burst of light.

Supernovas can briefly outshine entire galaxies and radiate more energy than our sun will in its entire lifetime. They're also the primary source of heavy elements in the universe.

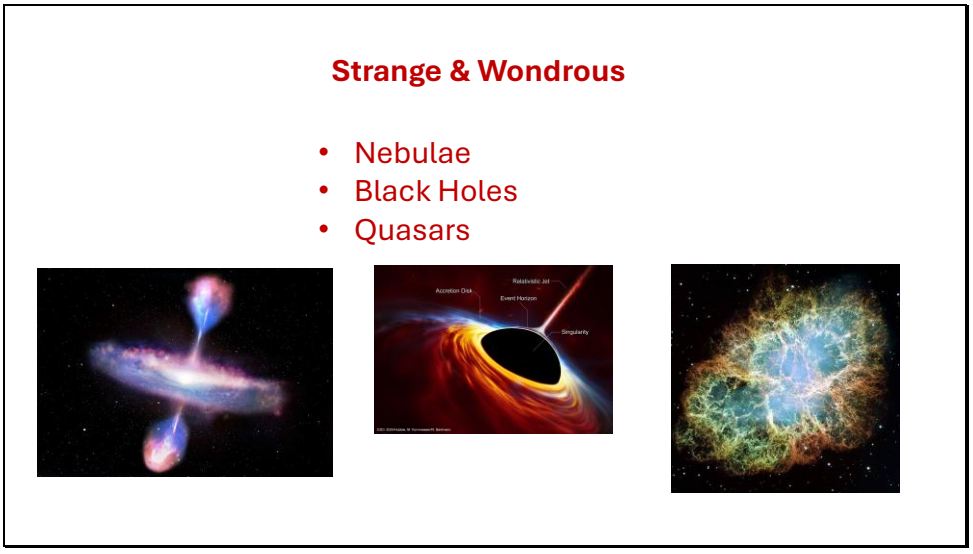
The **Crab Nebula**, arguably the most famous supernova, was first spotted by Chinese and Korean astronomers who recorded this star explosion in their records in 1054. Native Americans may have seen it as well, according to rock paintings found in Arizona and New Mexico. The supernova that formed the Crab Nebula was so bright that those early astronomers could see it during the day.

There are many different types of supernovae, but they can be broadly separated into two main types: thermonuclear runaway or core-collapse. This first type happens in binary star systems where at least one star is a white dwarf, and they're typically called Type Ia SNe. The second type happens when stars with masses greater than 8 times the mass of our sun collapse in on themselves and explode.” [2]

[1] https://science.nasa.gov/universe/stories/quick-reads/neutron-stars-are-weird
[2] https://www.space.com/6638-supernova.html

Supernova image = Cas A nebula

Slide 12



Nebulae – “A nebula is a giant cloud of gas and dust located in the space between stars. Nebula is Latin for "mist, vapor, fog, smoke, exhalation," but in an astronomical context, it refers to any celestial object that appears cloud-like when viewed through a telescope.

Some nebulas are formed when gas and dust are thrown out during a **supernova** —an explosion of a dying star, while other nebulas form through clouds of cold interstellar gas and dust. Nebulas come in many shapes and sizes and can be further divided into several subcategories including planetary nebulas, supernova remnants, dark nebulas and emission nebulas." [1]

Black Holes – "Super-massive black holes in the centers of some active galaxies create powerful jets of radiation and particles travelling close to the speed of light. Attracted by strong gravity, matter falls towards the central black hole as it feeds on the surrounding gas and dust. But instead of falling into the black hole, a small fraction of particles get accelerated to speed almost as great as the speed of light and spewn out in two narrow beams along the axis of rotation of the black hole. These jets are believed to be the sources of the fastest-travelling particles in the Universe -- cosmic rays.

In some cases these jets can reach outside of the galaxy itself, ending in giant radio lobes far from the active galaxy center. Observed with radio telescopes these galaxies can have a variety of shapes, mostly resembling dumbbells. We call these objects either **radio galaxies** or **quasars**, depending on how bright they are and how fast they consume the surrounding matter.

A small fraction of active galaxies with jets are oriented so that their jet is pointed straight at Earth. In those cases we observe radiation across the electromagnetic spectrum enhanced by the enormous speed of the jet and call such sources **blazars**." [2]

Quasars – "Quasars are the most luminous type of active galaxy. They emit light across the electromagnetic spectrum, produce powerful particle jets, and can radiate thousands of times the energy emitted by a galaxy like the Milky Way. The nearest quasar, called Markarian 231, is located some 600 million light-years away, but we see many more quasars the farther we look.

Scientists have identified over 1 million quasars, with the farthest one currently known lying about 13 billion light-years away." [3]

Blazar Alert– "A blazar is an active galactic nucleus that is powered by a supermassive black hole whose jet of plasma moves close to the speed of light and is pointed in a direction toward Earth. Astronomers at Caltech captured mind-blowing footage of a supermassive black hole spewing a jet of plasma straight toward Earth.

The school's astrophysicists released a high-resolution video of plasma coming out of a black hole millions of light-years away.

Video shows two different views of "blazar 3C 345" that is located around 5.5 billion light-years away from Earth in the northern constellation of Hercules. 27 years of telescope measurements were combined into the making of the video." [4]

[1] https://www.space.com/nebula-definition-types
[3] https://nustar.caltech.edu/page/relativistic-jets
[3] https://nustar.caltech.edu/page/relativistic-jets
[4] https://nypost.com/2026/09/23/us-news/caltech-astronomers-capture-incredible-video-of-supermassive-black-hole-blasting-out-a-blazar/

Slide 14 (13 omitted)

Make Known the Wonders of the Almighty

They shall speak of the glory of Your kingdom and talk of Your power; To make known to the sons of men Your mighty acts And the glory of the majesty of Your kingdom.
- Psalm 145:11-12

Great are the works of the LORD; They are studied by all who delight in them.
– Psalm 111:2