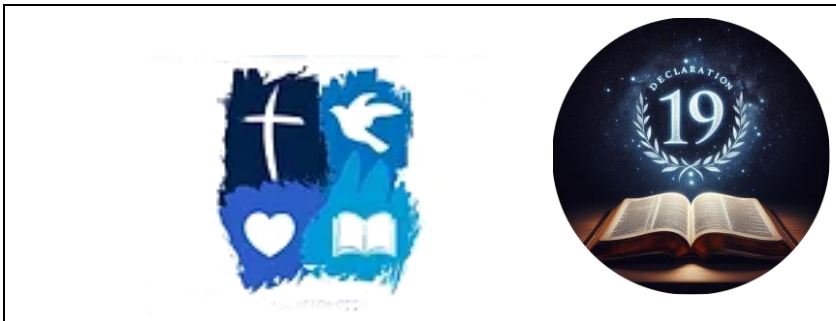


The Heavens Declare the Glory of God…
The Law of the Lord is Perfect, Restoring the Soul
Psalm 19

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

Building Blocks
Why does ice float? Why does it matter? Why don't atoms (or the universe itself) scatter instead of forming marvelous structures that support life? The answers to these and other questions leaves little doubt they were designed by a in intelligent, loving being to make a universe of order, design, and beauty.

Goldilocks
Not too hot, not too cold, this planet is just right. A LOT of things need to be just so to support life on earth, from heat, gravity, radiation and a raft of other things. Demonstrating Jesus' incredible intelligence and design makes short work of conventional science "just so" life-on-earth-by-accident stories.

To the Moon
Earth's moon is the source of light, bringer or tides & eclipses (and romance). Unlike other planets' moons, ours is unique in many ways. Ways that make life on earth possible

Our Neighborhood

Our tiny planet has a host of neighbors, big & small that provide beauty, awe, wonder, and protection!. See how God wisely placed these sentinels near our world and some fun facts about them.

Stars
The nuclear source of power and light for earth. Stars fill our sky at night and demonstrate only a God Wonders could make such a marvelous creation. Join us as learn how our very unique sun differs from most other stars created by God to bring us safe stable life.

Galaxies
Vast, almost unimaginably huge, these collections of strs and dust and other wonders pepper our vast, God-made universe with beauty, awe, and wonder.

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: Our Glorious Neighborhood

What's a Planet?
Marvelous Mars
Flotsam & Jetsam
The Cleanup
Put a Ring On It
Outer Limits

What's a Planet? – At one time we used to think asteroids were planets. Our definition is a moving target

Marvelous Mars – Mysterious Mars lines were once called canals, and invaded New Jersey in 1939(!), Mars is now known as a cold, dry, rusted planet.
Flotsam & Jetsam – Floating mysteriously between Mars and Jupiter are small planets or enormous rocks orbiting our sun; some are pursuing the potential wealth in some of these.
The Cleanup – Easily viewed from the night sky, our largest planet and its big red eye and amazing cleaning power!
Put a Ring On It – Breath-taking and glorious, our "Jewel of the Solar System is a glorious diadem of Go
Outer Limits –Uranus has secrets to reveal, and deep time believers aren't gonna like them, and we salute the forsaken world Pluto, forever a planet in our hearts.

Slide 5

The Big Idea

Display the **Power**, **Variety**, and **Control** of
Both the Stars and Their Maker

Slide 6

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

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.
The variety of stars, like people, plants and animals reflects God's love of beauty and great variety.
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 star, the sun reflects some of the great power under control of Jesus Himself.

Slide 7

Star Size

- 109 x as wide as Earth
- Weight 330,000 x
- Can Hold 1,300,000 Earths
- 5,470° / 25,000,000°

Mean distance from earth	149,600,000 km or 92,937,000 miles (1 astronomical unit (AU))
Diameter	1,392,000 km or 864,950 miles (109 x earth)
Mass	1.99 x 10^{30} kg (330,000 x earth)
Volume	1.412 x 10^{18} (1,300,000 Earths)
Mean density	1.41 g/cm^3 (1/4 earth)
Temperature	5,470 °C (9,880 °F) surface, 14,000,000 °C (25,000,000 °F) core
Power output	3.86 x 10^{26} watts
Escape velocity at surface	618 km/sec or 384 miles/sec (55 x earth)
Rotational period (days)	26.9 (equator), 27.3 (sunspot zone, 16°N), 31.1 (pole), all synodical25

[1] https://creation.com/en/articles/the-sun-our-special-star

Slide 8

Star Power

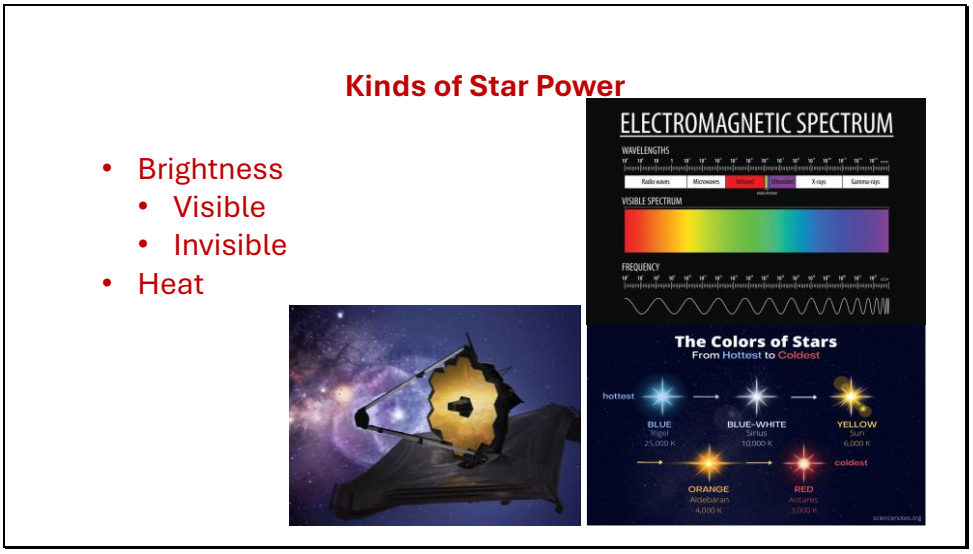
- Nuclear Powered
- Enough Mass / Energy for 15,000,000,000,000,000,000,000,000 years
- The sun's output for one second would supply the Earth for over 8000 years.

In 1939, Hans Bethe proposed that the sun and other stars are powered by *nuclear fusion*—this theory earned him the 1967 Nobel Prize for Physics.[5] In fusion, extremely fast-moving hydrogen nuclei join to form helium—this requires temperatures of millions of degrees. Some mass is lost and converted into a huge amount of energy as per Einstein's famous formula $E = mc^2$.[6] Thus the sun would be essentially a gigantic hydrogen bomb.[7] If fusion were totally responsible for the sun's huge power output of 3.86 x 10^{26} watts, four million tonnes of matter would be converted every second into energy—this is huge, but negligible compared to the sun's enormous total mass.[1]

The earth needs 6.2E+28 joules per year or 4.7152E+22 per second. The sun produces 3.86 x10^26 watts (joules/second). The surplus would supply us at present levels for the difference.[2]

[1]https://creation.com/en/articles/the-sun-our-special-star
[2] https://creation.com/en/articles/the-sun-our-special-star
[2] https://www.statista.com/topics/4042/global-energy-consumption/#topicOverview

Slide 9



Visible: - The brightness of stars is measured two ways: how bright they appear to us, apparent magnitude, and actual brightness, absolute magnitude. Measuring apparent magnitude is easy, just look up! Absolute brightness can be measured in a quite clever way we'll see a bit later.

Invisible: - Stars give off in frequencies the eye cannot see but can still be measured. For example, the James Webb telescope senses almost entirely in infrared frequencies.

"The James Webb Space Telescope, also called Webb or JWST, is a large, space-based observatory, optimized for infrared wavelengths, which complements and extends the discoveries of the Hubble Space Telescope. It has longer wavelength coverage and greatly improved sensitivity. The longer wavelengths enable Webb to look further back in time to find the first galaxies that formed in the early Universe, and to peer inside dust clouds where stars and planetary systems are forming today." [1]

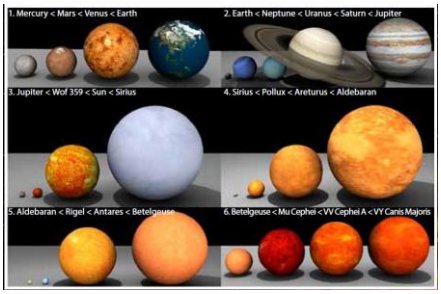
Heat - The brightness is influenced by how much radiation is given off, heat, which also affects the visible color. Like a dimmable light bulb, that's turned down, starting out brown, red, orange yellow, blue white, to blue.

[1]https://science.nasa.gov/mission/webb/faqs-full/

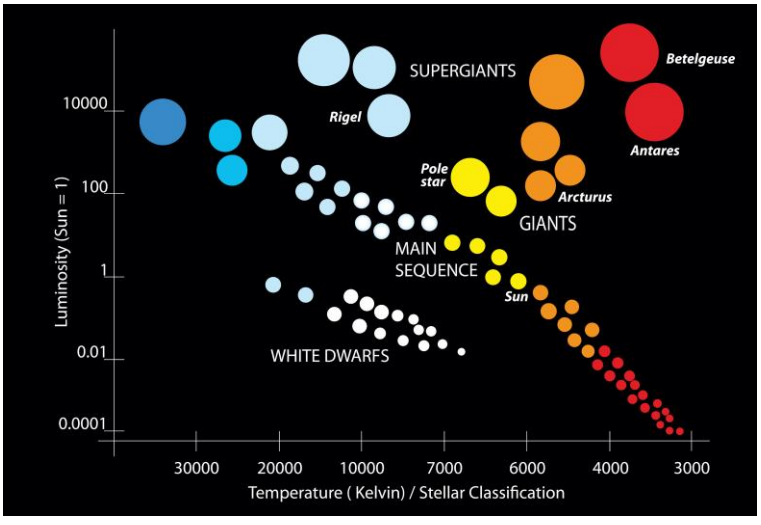
Slide 10

Kinds of Star Power

- Size
- Gimli Dwarf
- Combined



Slide 11



"Main sequence stars fuse hydrogen atoms to form helium atoms in their cores. About 90 percent of the stars in the universe, including the sun, are main sequence stars. These stars can range from about a tenth of the mass of the sun to up to 200 times as massive.

Smaller bodies — with less than 0.08 the sun's mass — cannot reach the stage of nuclear fusion at their core. Instead, they become brown dwarfs, stars that never ignite.

In the early 20th century, astronomers realized that the mass of a star is related to its luminosity, or how much light it produces. These are both related to the stellar temperature. Stars 10 times as massive as the sun shine more than a thousand times as much.

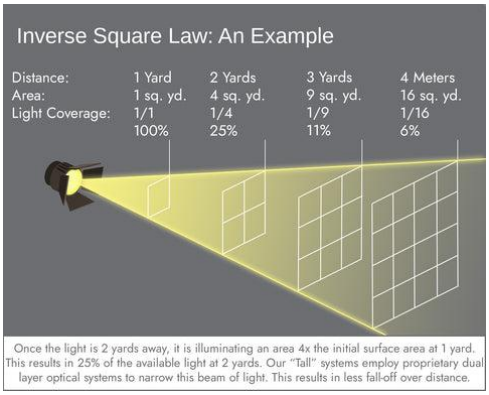
The mass and luminosity of a star also relate to its color. More massive stars are hotter and bluer, while less massive stars are cooler and have a reddish appearance. The sun falls in between the spectrum, given it a more yellowish appearance.

"The surface temperature of a star determines the color of light it emits," according to the worldwide Las Cumbres Observatory. "Blue stars are hotter than yellow stars, which are hotter than red stars.“” [1]

[1] https://www.space.com/22437-main-sequence-star.html

Slide 12

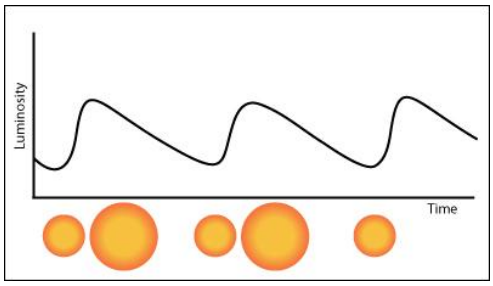
Another Display of God's Wisdom:
The Inverse Square Law



Slide 13

Cepheid Variables

- Predictable Standard Brightness
- Very Bright
- Can Measure Distance Very Accurately
- Uses Inverse Square Law



Cepheid variables are a class of pulsating stars that are among the most important **standard candles** in astronomy for measuring cosmic distances.

Why They're Useful as Standard Candles

Predictable Brightness –Period Relationship

Henrietta Swan Leavitt discovered (1912) that the pulsation period of a Cepheid variable is directly related to its intrinsic luminosity (absolute magnitude).

Longer period → higher luminosity.

This is known as the Leavitt Law or Period–Luminosity (P–L) relation.

How It Works

Astronomers measure the period of brightness variation from Earth.

Using the P–L relation, they determine the star's absolute magnitude.

Comparing absolute magnitude with apparent magnitude gives the distance via the inverse-square law of light.

Advantages

Very bright — visible in galaxies millions of light-years away.

Reliable — the P–L relation is well-calibrated using nearby Cepheids whose distances are measured by parallax (e.g., from Gaia mission data).

Works across a wide range of environments.

Role in the Cosmic Distance Ladder

Nearby Universe: Cepheids bridge the gap between **parallax measurements** (within our galaxy) and **Type Ia supernovae** (used for much farther distances).

Hubble Constant: Edwin Hubble used Cepheids in the Andromeda Galaxy to prove it lay outside the Milky Way, revolutionizing our understanding of the universe's scale.

Modern Cosmology: Cepheid-based distances calibrate other standard candles, helping refine the expansion rate of the universe.

✅ **Summary**:

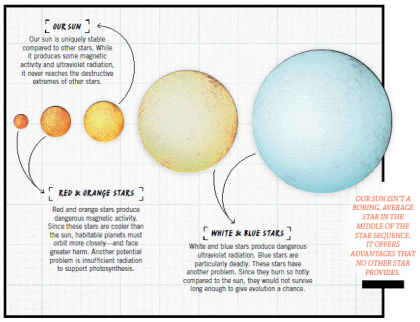
Cepheid variables are pulsating stars whose period of brightness variation reveals their true luminosity. This makes them powerful standard candles for measuring distances to nearby galaxies and calibrating the cosmic distance ladder.[1]

[1] *https://www.bing.com/search?q=cepheid+variables+as+standard+candles&qs=UT&pq=cepheid+variables&sk=MT1UT1&sc=10-17&cvid=40AA2192C39C4006A513A555B141993B&FORM=QBRE&sp=3&ghc=1&lq=0*>

Slide 14

The Meek Sun

- Composition
  - Elements - Lithium
  - Size
  - 1 vs > 1
- Stable Output
  - Heat & Brightness
  - Magnetic Output (Solar Storms)



Composition

Elements –

Less Lithium - Lithium content in the Sun is significant because lithium is easily destroyed in stellar interiors. Its unusually low abundance tells us how the Sun mixes, rotates, ages, and evolves—and whether its internal environment is stable. Lithium is basically a "fragile thermometer" for the Sun's internal conditions. If lithium is high, the Sun's outer layers are not mixing deeply. If lithium is low, the Sun's outer layers are mixing into hotter regions. It is well mixed, therefore stable1

Size – Larger stars tend to be unstable or not produce "Goldilocks zones", their planets are fried to a crisp; a yellow star like ours have the right gravity.

1 vs >1 – According to several sources, 85% of stars have one or more companions, make them unsuitable to support life due to drastic changes in sunlight, magnetism, and radiation. Although there is some dispute as to the number of binary or trinary or more star systems, there deleterious effect on life is indisputable 2,3,4

Stable Output

Heat & Brightness – Variable stars with even a percent of variation would cause temperature changes of 2°F on the earth; local and seasonal changes likely would be far higher and more disruptive to life. 2

Magnetic Output (Solar Storms) – "On earth we are familiar with the sun's magnetic field because it is intimately involved with sunspots (or in the case of other stars, star spots). Every 11 years the number of spots and magnetic activity increase. During sunspot maximum, the sun frequently produces energetic flares that bathe the earth in an extra dose of particle radiation that can wreak havoc on earth and damage cells in living organisms. We can only imagine how destructive the radiation would be on planets orbiting other stars… By God's gracious design, the earth has a protective magnetic field that prevents the sun's flares from disrupting life… Even on planets that do, the situation would be dire if the star's magnetic activity were far higher than the sun's. The much more frequent and far more powerful flares probably would compromise any reasonable magnetic field that a planet would have. [2]

Life requires a stable sun at all times, and that's just what God gave us. [2]

[1] Co-Pilot AI answer to significance of lithium in the sun.

[2] https://answersingenesis.org/astronomy/sun/not-just-another-star/

[3] https://astrobservers.com/wp-content/uploads/2023/11/Binary-systems.pdf

[4] https://www.space.com/1995-astronomers-wrong-stars-single.html

Slide 15

The Meek Son

Who has believed our message? And to whom has the arm of the LORD been revealed? For He grew up before Him like a tender shoot, And like a root out of parched ground; He has no stately form or majesty That we should look upon Him, Nor appearance that we should be attracted to Him.

He was despised and forsaken of men, A man of sorrows and acquainted with grief; And like one from whom men hide their face He was despised, and we did not esteem Him.
– Isaiah 53:1-3

Meekness has been defined as strength under control. How glorious our King – Creator, made our sun meek for our benefit, and made Himself meek also for our benefit.

Slide 16

The Meek Son

Have this attitude in yourselves which was also in Christ Jesus, who, although He existed in the form of God, did not regard equality with God a thing to be grasped, but emptied Himself, taking the form of a bond-servant, and being made in the likeness of men.

Being found in appearance as a man, He humbled Himself by becoming obedient to the point of death, even death on a cross. – Philippians 2:5–8