**Quizlet Set By Ali**

Light is a wave and a particle. This is the duality of quantum of light. It is called a photon. It has NO mass but it does have energy and momentum

Particles also have wave like properties

An observer that is moving can change the frequency or color of light (E=mc­2)

General Relativity: All laws of nature are the same for observers moving in an arbitrary way relative to one another

The Principle Of Equivalence: No experiment performed in one place can distinguish a gravitational field from an accelerated reference frame

Light does not bend much because it travels very fast. In a distance of 10 meters, it bends the size of a nucleus

Space time and gravity are hard to measure on earth but can be seen when light passes close by something that is massive in size

Light bends in a gravitational field. Light leaving a gravitational field is red-shifted; lower frequency

If a black holes field becomes strong enough, the light does not escape and time appears to run slowly

Black holes DO NOT SUCK. It is gravitational pull that lures in objects

Time advances more slowly for observers closer to a gravitational source. It is a small but measurable difference

Einstein viewed matter and energy as the same

Light does not change direction but follows the curvature of space

Gravitational Lensing: Large mass between us and a distant galaxy gives a distorted image of the galaxy because light bends due to gravitational pull

General Relativity is based on: Principle of equivalence, gravitational redshift, gravitational time dilation, gravitational waves, gravitational lensing, curved space time

Transit Method: Watch a star very closely, patiently and continuously. If a planet passes in front of it, the star will appear dimmer. Only works for large planets

Doppler Method: Uses the spectrum of stars to measure its speed of motion towards or away from us; Changes according to a planet’s orbit

Methods for finding extra solar planets: Transit method, Doppler method, and direct imaging

There is life on earth because: location, timing, atmosphere, water, global climate, impacts, and supernovae

Europa [Jupiter’s Moon]: Liquid water possibly exists beneath the moons icy surface

Titan (Saturn’s Moon): Has similar conditions to those as early earth. Has liquid on its surface and may have water beneath the surface

Life depends on three things: Liquid water, organic molecules, and a source of energy like the sun

SETI: Is a mission to explore and understand and explain the origin and nature of life in the universe

Phoenix Project: Searches for radio signals from ET

Drake Equation: Estimates the number of extraterrestrial civilizations in our galaxy which may have life

Alan Telescope Array: Monitors 1 million stars within 1000 light years

Solar System started as a big cloud of gas and dust. It was a competition between forces – gravity pulling in and pressure pushing out

Conservation of angular momentum: As gas cools and collapses it forms disks

The Asteroid Belt is a ring of asteroids between the orbits of Jupiter and Mars

The Asteroids in the Belt are dominated by carbon, silicates, or iron-nickel compounds

The Asteroid Belt contains a dwarf planet, Ceres

The Kuiper Belt is a thick ring just beyond the orbit of Neptune

The Kuiper Belt is composed of 4 dwarf planets: Haumea, Makemake, Eris, and Pluto

The Oort Cloud is a theoretical sphere of debris that is around 1000x times further than the Kuiper belt. It contains small dirty snowballs of ice

Comets have a very elongated orbit

As comets approach the sun they lose mass and their gas vaporizes leaving a trail of dust and gas

When Earth passes through comet trails, we get meteor showers

Meteors are rocky debris that collide with the earth’s atmosphere and burn up

A small meteor is called a meteoroid

If a meteor passes through the atmosphere it is called a meteorite

Our sun is a low mass stars

Low mass stars live for billions of years

Low mass stars end their lives as a planetary nebula and then a white dwarf

High mass stars live fast and die young

Lifetime of a star is determined by its mass divided by luminosity

High mass stars: More mass 🡪 stronger gravity 🡪 higher pressure 🡪 faster nuclear reaction rates 🡪 greater luminosity

In a supernovae, the iron core collapses and bounces outwards. It forms elements heavier than iron

A neutron star is very dense because the matter is tightly squeezed together

Black holes are created from high mass stars that are greater than 3 solar masses

Sagittarius A is a black hole at the centre of our galaxy

Schwarzschild radius: The larger the mass of an object, the larger the critical radius

In a normal star the gravity is balanced by pressure from nuclear fusion

The length of the main sequence tells you the age of the star

Our sun is 4.5 billion years old

Our sun will shine for another 5.5 billions years

Evidence for big bang: Cosmic background radiation, big bang nucleosynthesis, Hubble expansion, homogeneity of universe, age of stars

Currently, the universe is expanding into itself. Objects that are far away are moving further away from us. This is the red shift effect.

The observable universe is the region of space of which light has had time to reach us

Our universe is only 13.7 billion years old

Evidence for dark matter: Motion of galaxies in clusters, spiral galaxy rotation curves, and gravitational lensing

The Andromeda galaxy is the closest galaxy to our galaxy, the Milky Way

Spiral galaxies keep their size and shape by rotating. Each star in it is around the centre of the galaxy. The speed of rotation depends on the mass inside the orbit. More mass = faster rotation

Gravitational lensing: The more mass along the line of sight, the more light will be deflected

Dark Matter accounts for 90% of the mass of galaxies and clusters

Dark Matter is a type of mass that does not emit light. It is detectable through its gravity