

ASTROEDU Toronto, Canada 2023 Astronomy Lesson Plans for High School in Africa

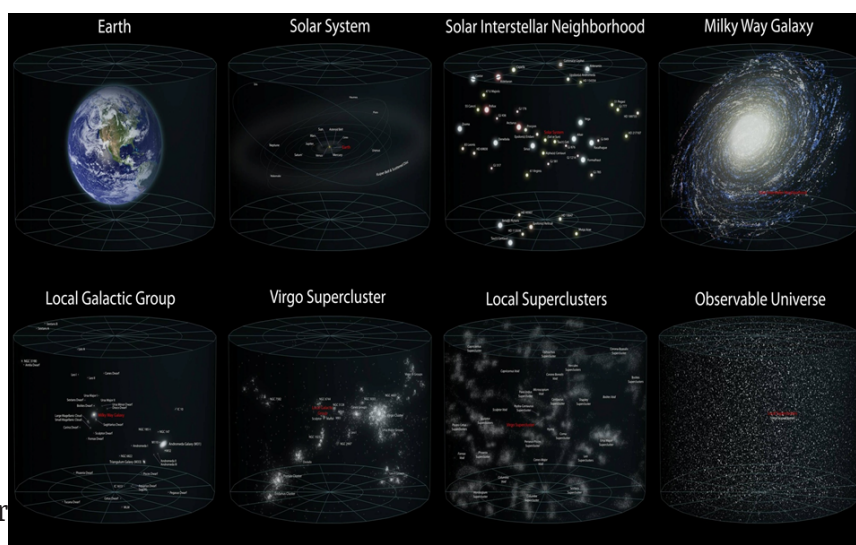
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Astronomy which is the study of the cosmos continues to change our understanding of the universe. Astronomy education is very crucial for sustainable space development as young students are the next generation astronauts, scientists and engineers. Astronomy education should be started as early as possible in high school to motivate children toward the adventure of the universe but in Africa it is not integrated into the formal science curriculum. However some of them have planned to incorporate astronomy as one course in high school studies after considering its significant for development. In this continent, this future class program is designed to provide a non-technical overview of basic astronomy topics with creative space activities. The course must be given with high cost effective methods such that some astronomical tools can be available with home-made materials. The general lesson plan of it has to be basic and must apply and link with STEM fields. The curriculum outline design for the high school level is intended to be given from grades 9 to 12. The following contents must be included in their respective grades:-

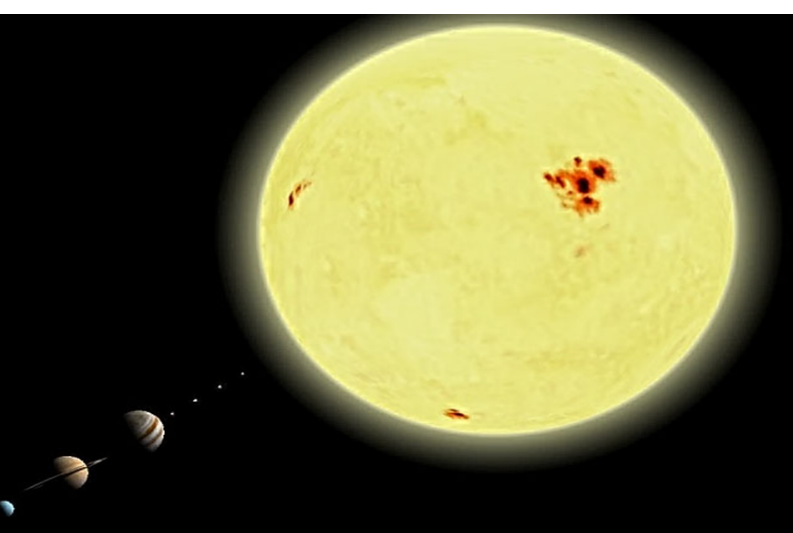
Grade 9:- Introduction to Astronomy and the Universe

1. Preview of the Cosmic Landscape - Charting the Heavens & scale of the Universe
2. Navigating the night sky - Discovering the Night Sky & constellations
3. History of Astronomy-Ancient, Classical & rise of Astronomy
4. Gravity and Motion- Astronomical applications of Kepler's, Newton's laws & Einstein's relativity
5. Electromagnetic waves and Atoms - Information from the Cosmos and Electromagnetic spectrum
6. Telescopes- Optics, simple , earth-based & space-based telescopes

Activities -> Stargazing ,Star Umbrella for circumpolar constellations, building spectroscopy, building a simplified quadrant, Eratosthenes measurements & building simple telescopes



Grade 10:-Solar system



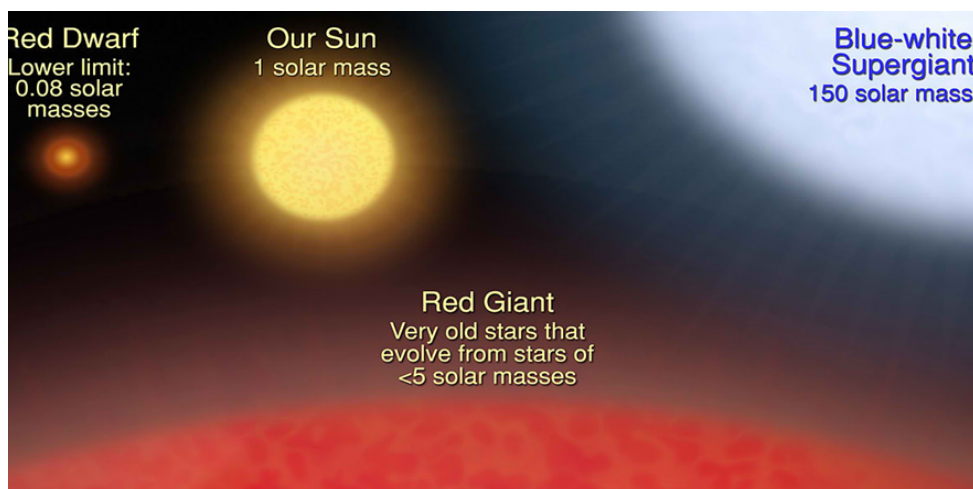
1. Survey of Solar Systems : Comparative Planetology
2. The Terrestrial (Inner) Planets and Their Moons- Mercury, Venus, Earth, and Mars,
3. The Jovian (Outer) Planets and Their Moons-Jupiter, Saturn, Uranus, and Neptune
4. Solar System Debris- Dwarf Planets, Asteroids , Comets, Meteoroids, Meteors, and Meteorites
5. Exoplanets- Planetary Systems Beyond Our Own
6. Space Exploration - Space rockets, Satellites and spaceships

Activities->Modeling the sizes and distances of Sun and the planets using balloons , Size of the Sun using Pinhole camera, phases and eclipse of the Moon, building water rocket

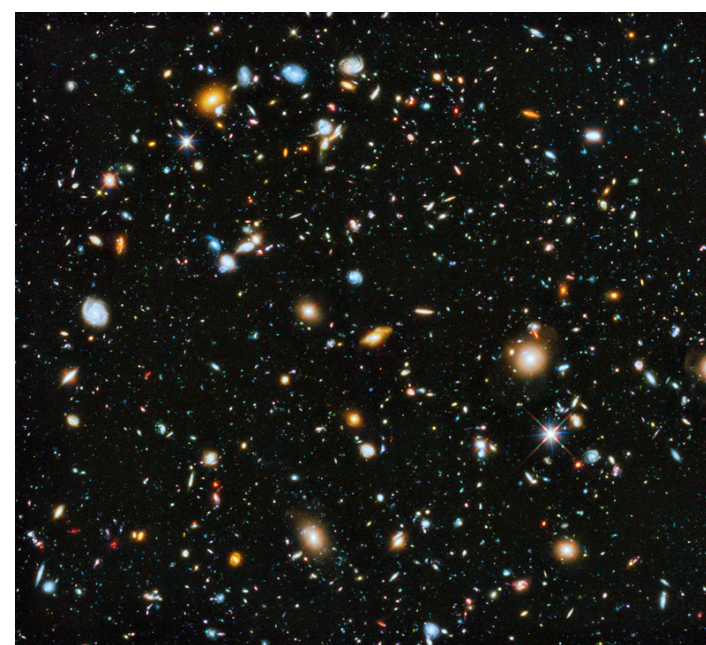
Grade 11:-Stars and stellar evolution

1. The Sun - our star
2. Measuring the Properties of Stars:- Temperature ,Radius and Mass
3. Classification of Stars:- Giants, Dwarfs, & the Main Sequence
4. Stellar Evolution: The formation, Life & Death of a Star
5. Stellar Explosions: Novae, Supernovae, & the Formation of the Elements
6. Stellar Remnants: White Dwarfs, Neutron Stars, and Black Holes

Activities ->Determination of Solar Luminosity Oil Spot Photometer , Distance determination using parallax method ,color vs temperature relations Pulsar simulation



Grade 12:- Galaxies and Cosmology



1. The Milky Way Galaxy-A Spiral in Space
2. Galaxies-Building Blocks of the Universe and the Distribution of Galaxies in Space
3. Types of galaxies-Hubble's Galaxy Classification
4. Measuring the Properties of Galaxies- distance, luminosity and mass
5. Dark Matter and dark energy
6. The Large-Scale Structure of the Cosmos
7. The evolution of the Universe - Big Bang, present-day state & fate of the Universe
8. Life in the Universe- Are We Alone?

Activities->Modeling and drawing galaxies , Expansion of the Universe using Balloon dots, Space curvature simulation, Doppler's effect experiment

Conclusions

- In general, Astronomy teaching can promote rational and critical thinking & understanding of nature.
- In Africa ,the lack of experienced teachers and astronomical instruments will be compensated by favorable conditions of less light pollution and unobstructed clear sky.
- It's very important to carefully arrange the course syllable that will adapt with the facilities and materials that these countries can provide.
- We should encourage students and teachers to create new innovative techniques to simulate celestial bodies & phenomena .
- Therefore, we can accomplish space education in high school with less budget and complexity.
- However, international cooperation is needed for advanced Space education.