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School *on* Astronomy, Space Science & Technology

November 20-22, 2017 (Mangsir 4-6, 2074)

Abstract of the Talks

FIRST DAY (4 Mangsir, 2074)

Origin and Evolution of the Universe

Prof. Dr. Binil Aryal

Central Department of Physics, Tribhuvan University, Kirtipur

The Universe was believed to be very compact at the beginning. The beginning of time starts from the expansion of the space. We call it big bang and the complete scenario of its evolution is named as the standard model of the big bang theory. In this talk, I will briefly explain the radiation dominated and matter dominated epoch. A description regarding the formation of matter through baryogenesis and leptogenesis process will be explained and discussed. In addition, the reason behind structure formation through nucleosynthesis will be described. Finally a picture of future scenario will be explained in the framework of HDM and LCDM model..

Dynamic Sun and our Solar System

Raju Khanal

Central Department of Physics, Tribhuvan University, Kirtipur

Sun is the only star in our solar system and plays the most important role in all activities within the solar system. Sun is not just a fireball as commonly believed by most of the people. Various scientific explorations have revealed the dynamic nature of the Sun which will be presented and discussed. Various phenomena like solar cycle, dark spots, solar flares, coronal mass ejection, etc. will be illustrated with the resources available after various solar observations. In addition, a review of our solar system will also be presented.

Interstellar Medium

Mr. M. Paudel

Tri-chandra College, Ghantaghar, Kathmandu

Although space is very empty and the stars in the Milky Way are very far apart, the space between the stars contains a very diffuse medium of gas and dust astronomers call the interstellar medium (ISM). This medium consists of neutral hydrogen gas (HI), molecular gas (mostly H2), ionized gas (HII), and dust grains. Although

the interstellar medium is, by several orders of magnitude, a better vacuum than any physicists can create in the laboratory there is still about of 5-10 billion M of gas and dust out there, comprising approximately 5% of the mass of visible stars in the Galaxy. About 1% of the mass of the ISM is in the form of tiny grains of dust about the size of particles of cigarette smoke. We have already described how this dust obscures the plane of the Milky Way from our view. Dust is responsible for the blue haze around the Pleiades star cluster (Messier Database, (Web Nebulae); this nebulosity is called a reflection nebula resulting from blue light from the hot B-stars being scattered toward us from dust surrounding the cluster stars. Supernova remnants like the Crab Nebula enrich the ISM with elements heavier than helium as the expand into the ISM with speeds of several thousand km/s.

SECOND DAY (5 Mangsir, 2074)

Issue of Distance Measurement of Celestial Bodies

Mr. Rajesh Kumar Bachchan
Patan M. Campus, Tribhuvan University, Patangate, Lalitpur

Distance measurement has always been a challenging task in Galactic and extragalactic scale. By the method of stellar parallax, distances of the order of few kiloparsec (1 parsec is 3.26 light year) can be measured. To measure even larger distances, objects like cepheid variables or RR Lyrae variables are used. To measure distance in the order of megaparsec, standard candels like Type Ia supernovae is used. A brief introduction to measure distances varying from parsec to megaparsec will be presented.

Orientation of Satellites and Their Impact on Space Weather

Dr. Binod Adhikari
St. Xaviers' College, Maitighar

The solar output and its variations depends up on several interplanetary parameters such as solar wind velocity, solar wind density, interplanetary magnetic field, solar wind pressure and solar wind temperature. Geomagnetic disturbances are generally represented by geomagnetic storms and sudden ionosphere disturbances. The orientation of the satellites play crucial role for the variation on these parameters. In this presentation, the main focus will be given on orientation of the satellites: ACE, WIND and GEO-TAIL and possible impact of geomagnetic disturbances on space weather observed from these satellites.

An Introduction to Cosmology

Prof. Dr. Mukunda Mani Aryal
Central Department of Physics, Tribhuvan University, Kirtipur

Cosmology is the study of the origin, evolution, and eventual fate of the universe. Physical cosmology is the scientific study of the universe's origin, its large-scale structures and dynamics, and its ultimate fate, as well as the scientific laws that govern these areas. Religious or mythological cosmology is a body of beliefs based on mythological, religious, and esoteric literature and traditions of creation myths and eschatology. Physical cosmology is studied by scientists, such as astronomers and physicists, as well as philosophers, such as metaphysicians, philosophers of physics, and philosophers of space and time. Because of this shared scope with philosophy, theories in physical cosmology may include both scientific and non-scientific propositions, and may depend upon assumptions that cannot be tested. Cosmology differs from astronomy in that the former is concerned with the Universe as a whole while the latter deals with individual celestial objects. Modern physical cosmology is dominated by the Big Bang theory, which attempts to bring together observational astronomy and particle physics; more specifically, a standard parameterization of the Big Bang with dark matter and dark energy, known as the Lambda-CDM model.

Beyond the Solar System: An Overview

Dr. Vinay Kumar Jha
St. Xaviers' College, Maitighar

The history of successful interplanetary space mission is begun by United States in early sixties of last century after sending theMariner 2 to the planet Venus which collected the data from around35,000 kmof the Venus.In a last few decades, due to advancement in technology, robotic spacecraft is being used in the space exploration.The first robotic spacecraft is sent under joint venture by the NASA, Indian Space Research Organization, Soviet Union,European Space Agency and the Japan Aerospace Exploration Agencywhichhas produced number of discoveriesand revolutionized our view about Solar system. In 1977, the Voyager mission was launched which was one of the fruitful missionsas it provided many examples of the process of discovery. Voyager revealed that the moon of the Jupiter named Iowas volcanically active and confirmedthe theories of tidal heating, and another moon, Europa is nearly crater-free icy surface which suggests recent resurfacing and the possibility of liquid water. Voyager also noticed about the Saturn's largest moon Titan that it's atmosphere is thick and rich in hydrocarbons, and another moon, Enceladus (the sixth-largest moon of Saturn) to have amazingly geologically young surface. Until now, much more information has been obtained about major planets of the solar system but a little has been knownabout a trans-Neptune region, theKuiper belt and Exoplanets.The Kuiper belt is a disc-shaped region of icy bodies which includes dwarf planets such as Pluto and

comets beyond the orbit of Neptune, extending from the orbit of Neptune (at~30 AU) to approximately 50 AU from the Sun. This belt is similar to the asteroid belt, but is far larger ~20 times as wide and 20 to 200 times as massive. Beyond this Kuiper belt, there are also planets of other star systems called Exoplanets. The study on such planets is very essential as we are seeking forplanetslike the Earth where lives are possible. This presentation comprises an overview on the Kuiper belt and Exoplanets.

THIRD DAY (6 Mangsir, 2074)

Geographical Positioning System & Remote Sensing

Mr. D. Upadhayay
Amrit College, Ghantaghar, Kathmandu

Geographic Information System is a computer based system for storing, checking, manipulating, analyzing and displaying data which are spatially referenced to earth i.e. geographically corrected.. Georeferenced data define objects that have orientation and relationship in two or three dimensional spaces. Though GIS handles large amount of spatial and aspatial data, it lacks adequate spatial information and is static. However it becomes more effective when real time satellite remote sensing images are incorporated along with sets of other data sets. So satellite remote sensing data are an important source of spatial data of earth surface as an input to GIS but in raw format it contains geometrical distortion which make them unusable as geographically standard data sets These geometric distortions may be in general caused by earth curvature , atmospheric refraction and panoramic distortion. The objective of the geometric correction is to correct for these distortions to produce an image geometric integrity of map. So that map represents surface such that any measurements made on the map agree accurately with the corresponding measurements made on the ground.

Gravitational Waves

Prof. Dr. Uday Raj Khanal
Central Department of Physics, Tribhuvan University, Kirtipur

A gravitational wave is a concept predicted by Einstein's theory of general relativity. General relativity states that mass distorts both space and time in the same way a heavy bowling ball will distort a trampoline. When an object accelerates, it creates ripples in space-time, just like a boat causes ripples in a pond (and also similarly an accelerating electrical charge produces an electromagnetic wave). These space-time ripples are gravitational waves. They are extremely weak so are very difficult to detect. Missions like LISA or LIGO hope to spot gravitation waves detecting small changes in the distances between objects at set distances; satellites for LISA and mirrors for LIGO. As the strength of the wave depends on the mass of the object our best hope of detecting

gravitational waves comes from detecting two black holes or pulsars collapsing into each other. Gravitational waves have been inferred from watching two pulsars spinning and noticing they are slowing down, due to losing energy from emitting gravitational waves. Gravitational waves are important in telling us about the early universe. The cosmic microwave background gives us a snapshot of the universe about 380,000 years after the start of the universe. Looking very closely at the cosmic microwave background there are patterns seen which can are also be measured in the large scale structure of the universe (so galaxies and clusters) today. These patterns in the cosmic microwave background were caused by very tiny random perturbations from the time when the universe expanded rapidly, known as inflation. Inflation should also generate gravitational waves. These waves affect the polarisation (the way the wave oscillates) of the cosmic microwave background. Measuring the strength of the polarisation due to gravitational waves gives us a ballpark figure of the amount of energy involved at the time of inflation and helps pin down when inflation occurred.

Space System and Radio Wave Communication

Dr. Narayan P. Chapagain
Patan M. Campus, Tribhuvan University, Patangate, Lalitpur

Space science deals with the study of wide ranges of topics including solar system that is solar wind, planetary magnetosphere, ionosphere, auroras, cosmic rays, and synchrotron radiation and so on. This paper presents the overview of lower space system, mainly the Earth's ionosphere, which consists of ionized gases. This region extended from about 50 km-1000 km altitudes. Thisionospheric layer is predominantly responsible for the GPS (global position system) communication and navigation systems. However, during the night-time period, ionosphere is highly variable resulting the ionospheric irregularities. When radio signals propagate through theseirregularities, they cause distortion in amplitude and phase that affect on communication and navigation systems.