Report of

National Workshop on

Astronomy & Astrophysics

(NWAA2013)

25-28 June 2013, Tribhuvan University, Kirtipur, Kathmandu, Nepal

Project Leader

Prof. Dr. Binil Aryal

Organized by

Central Department of Physics

Tribhuvan University, Kirtipur, Nepal

30 June 2013

Project Leader: Prof. Dr. Binil Aryal

National Workshop on Astronomy and Astrophysics 25-28 July 2013, Kathmandu, Nepal (NWAA2013)

1 Background

The second half of the twentieth century has witnessed a tremendous development in the field of Astronomy and Space exploration. Spacecrafts have reached the remotest region of solar system. Man has landed and walked on the Moon. Astronauts and Cosmonauts have spent long periods in space station, carrying out experiments in zero gravity in preparation for cosmic journeys. Space Shuttling and space walk have become almost a routine affair. On the other hand telescope both on the land and in the orbit, using the whole range of the electromagnetic spectra from radio waves to gamma rays are extending their range of exploration, right to the edge of the observable universe and making astounding discoveries in the process. Astrophysics is the branch of astronomy that deals with the physics of the universe, including the physical properties of celestial objects, as well as their interactions and behavior. Central Department of Physics, Tribhuvan University has been helping to bring the world of Astronomy & Astrophysics to interested Nepalese students since 2008 by offering Astrophysics as an elective course in the Master's level. In spite of this, more than 300 M.Sc. (Physics) students have completed M.Sc. (Physics) with 'Astrophysics' as an elective paper in the eight different colleges all around the country. At present, in the country, more than 450 M.Sc. (Physics) students are studying Astrophysics as a major in the second year. Till date 73 masters' thesis have been completed in Astrophysics. Currently, five students are doing Ph.D. and 22 are involved in the research work in Astrophysics for their masters' thesis in the department. A few of masters' theses are published in the reputed Journals like MNRAS, A&A, Ap&SS, RAA and BASI. The research areas are galaxy evolution, dust structures around PNe, White Dwarfs and Pulsars, chirality of large scale structure, modeling galaxy rotation curve and observational work (16 inch Schmidt Telescope). Additional Information regarding publications, past and present on-going Ph.D. research and M.Sc. dissertation work are available in http://astronepal.webs.com. We also have a few experiences of collaborative work and organizing/hosting conferences in the various aspects of A&A in the past. Central Department of Physics have successfully organized International Conference on Astrophysics and Cosmology (ICAC2012) in Kirtipur, Kathmandu during March 19-21, 2012 under the leadership of Prof. Dr. Binil Aryal.

Fig. 1 Opening Ceremony: The workshop is officially opened by the Rector of Tribhuvan University *Prof. Guna Nidhi Neupane.*

Keeping aspiration of young Astronomy graduates in mind, Central Department of Physics have decided to organize a workshop in order to provide an extensive learning environment. We intend to provide an exposure to the virtual observatories, database, software and basic programming language which is commonly used in astrophysical research. Our aim is to make students familiar with the process of problem identification as well as problem solving procedure. The workshop is mainly for photometry and spectrometry. For this, we use the data available in the ADS/SIMBAD/NED/SkyView.

NWAA2013 is organized by the Central Department of Physics, Tribhuvan University in its premises at Kirtipur, Kathmandu during 25-28 June, 2013 (11-14 Asad, 2070 B.S.). The event is officially opened by Prof. Guna Nidhi Neupane, Rector of Tribhuvan University, Nepal on 25 June 2013. During opening ceremony, Dean on Institute of S&T Mrs. Chirik Shobha Tamrakar, Assistant Dean Prof. Dr. Chet Raj Bhatta, Prof. Lok Narayan Jha, Head of the Central Department of Physics, and Exec-

Central Department of Physics
Tribhuvan University, Kirtipur, Kathmandu, Nepal.
E-mail: binil.aryal@uibk.ac.at

Fig. 2 Participants and guests listening audio visual message from *Kevin Goverder*, Director, IAU Office of Astronomy for Development during the opening ceremony.

utive Director of Ministry of S&T Dr. Shobha Kanta Lammichhane were present. Prof. Binil Aryal welcomed the chief guest and guests. He presented souvenir to the guests. In the beginning, audio visual message from *Kevin Goverder*, Director, IAU Office of Astronomy for Development during the opening ceremony was displayed. All guests and participants acknowledged the contribution of IAU and wished that IAU will continue their supports to the University Research Program in the future. On that occasion, T-shirts (with IAU's official logo) and workshop key-rings are distributed to the guests as well as to all participants.

This event was supported by Tribhuvan University, Ministry of S&T, International Astronomical Union (IAU), Nepal Physical Society (NPS) and Astrophysics and Cosmology Research Group. The purpose of this workshop is to bring together experienced as well as young students who are interested in working actively on various important aspects of Astronomy & Astrophysics using the data available in the internet.

2 Objectives

The aim of this workshop is to create interests towards A&A research. We intend to cover data reduction and computational aspects of A&A to the undergraduate and graduate students. There is a huge database, catalogs, virtual observatories that can be accessed through the internet. Interactive software is available in the internet. We have been using these databases and software for the masters' thesis and Ph.D. work at the Central Department of Physics, Tribhuvan University since 2005. A quite a good number of papers have been published in the international referred Journals (MNRAS, A&A, Ap&SS, RAA, BASI, etc) because of our effort. A&A research activity is limited to only this department (Central Department of Physics, Kirtipur). There are 8 other colleges in the nationwide where Astrophysics course have

Day (2013)	08:30-09:00	09:00-10:30	10:30-10:45	10:45-12:15	12:15-13:45	13:45-14:30	14:30-16:00	16:00-16:30	16:30–18:00
25 June	Opening Ceremony	IPN L1	TEA BREAK	BA L2	LUNCH	POSTER	T1-T2 UB	TEA BREAK	T3-T4 BA
26 June		BA L3		IPN L4			T5-T6 MT		T7-T8 MT
27 June		RK L5		MMA L6			T9-T10 ML		T11-T12 ML
28 June		KRB L7		URK L8			T13-T14 PY		T15 PY/CS

Fig. 3 Outline of the program.

been offered. In these colleges, more than 180 students have chosen astrophysics as a major. Due to the lack of research-experts, these students have not been exposed with the method of research work in A&A (problem identification process and basic computation). The Central Department of Physics has been receiving requests from the students and official letters from their colleges requesting to organize a workshop so that undergraduate students of other colleges can be benefited.

The objectives of NWAA 2013 are as follows:

1. To provide an opportunity to learn the computation and data reduction skill to the undergraduate and graduate students who have chosen Astrophysics as a major.

2. A method of problem identification and solving procedure will be taught and discussed.

3. To bring together experienced as well as young astronomy graduates who are interested in working actively on various important aspects of Astronomy & Astrophysics in Nepal.

4. To persuade the appropriate authorities to revise Astronomy courses in the academic curriculum of colleges and universities.

3 Program

The program of the workshop is shown in Table 1. A brief description of the program is described below. There were 8 talks in the preliminarily session and 16 tutorials in the working session. Participants were divided into four groups during tutorial session. All participants have installed the programming language PYTHON in UBUNTU interface and the software MATHEMATICA, MATLAB and ALADIN in their Laptops.

The details of the program as listed in Table 1 is as follows:

25 June 2013

Opening Ceremony

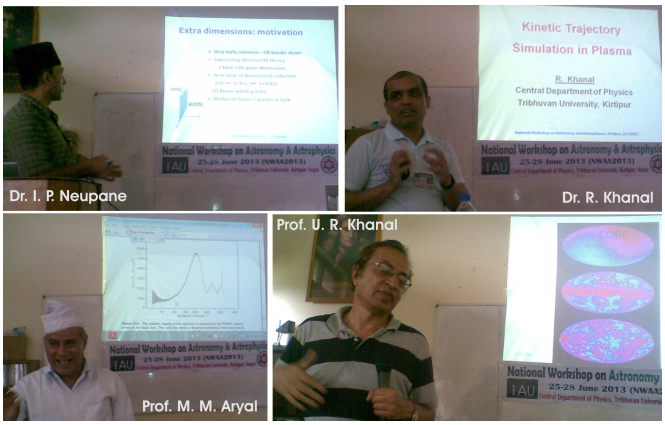

Fig. 4 Speakers delivering talks.

NWAA2013 is officially opened by Prof. Guna Nidhi Neupane, Rector of Tribhuvan University, Nepal. On that occasion, Dean on Institute of S&T Mrs. Chirik Shobha Tamrakar, Assistant Dean Prof. Dr. Chet Raj Bhatta, Prof. Lok Narayan Jha, Head of the Central Department of Physics, and Executive Director of Ministry of S&T Dr. Shobha Kanta Lammichhane addressed the participant. The physicists Prof. Sitaram Byhaut, Dr. Raju Khanal, Dr. Rajendra Parajuli, Dr. Ram Prasad Mainali and Dr. Narayan Prasad Adhikari were present on the occasion. All the speakers advocated the importance of similar workshop in order to create environment for the better research work in the University. They all thanked the International Astronomical Union (IAU) for the 'Astronomy program for University Research'

Preliminarily Session

Lecture 1 (L1)

Title: *Understanding the Universe: Cosmology after PLA NCK (part 1)*
Speaker: **Dr. Ishwaree Prasad Neupane**
Affiliation: CERN, Theory Department, CH-1211 Geneva 23, Switzerland
Abstract: The last two decades has witnessed two remarkable advances in physics. One is observational and the other is purely theoretical. The observational development was that the observable universe is not only expanding but its expansion rate is also increasing with time, implying an accelerated expansion of the universe on a large scale. This is a single experimental observation that has completely transformed the way many people think about the fundamental physics and laws of gravity. The most important theoretical development is the realization of the fact that it is possible to combine quantum mechanics and general relativity ? under a self-contained mathematical model (known as string theory) that describes all fundamental forces and forms of matter, by imposing the existence of six (or even seven) extra dimensions to the universe that have been compactified into extremely small scales, in addition to the four known spacetime dimensions. In this talk, I will give an overview of the Planck results.

Lecture 2 (L2)

Title: *Introduction to Operating System: Unix to Ubuntu*
Speaker: **Prof. Dr. Binil Aryal**
Affiliation: Central Department of Physics, Tribhuvan University, Kirtipur, Nepal
Abstract: Early computers were built to perform a series of single tasks, like a calculator. Basic operating system features were developed in the 1950s, such as resident monitor functions that could automatically run different programs in succession to speed up processing. Operating systems did not exist in their modern and more complex forms until the early 1960s. An operating system (OS) is a collection of software that manages computer hardware resources and provides common services for computer programs. The operating system is a vital component of the system software in a computer system. Application programs usually require an operating system to function. Time-sharing operating systems schedule tasks for efficient use of the system and may also include accounting for cost allocation of processor time, mass storage, printing, and other resources. For hardware functions such as input and output and memory allocation, the operating system acts as an intermediary between programs and the computer hardware, although the application code is usually executed directly by the hardware and will frequently make a system call to an OS function or be interrupted by it. Operating systems can be found on almost any device that contains a computerfrom cellular phones and video game consoles to supercomputers and web servers. A real-time operating system is a multitasking operating system that aims at executing real-time applications. A multi-user operating system allows multiple users to access a computer system at the same time. A multi-tasking operating system allows more than one program to be running at a time, from the point of view of human time scales. A distributed operating system manages a group of independent computers and makes them appear to be a single computer. Embedded operating systems are designed to be used in embedded computer systems. In this talk, I will discuss about the basic difference between UNIX, BSD, LINUX and MS WINDOWS. In addition the importance of the choice of suitable operating system particularly for the research work in Astronomy and Astrophysics will be thoroughly discussed.

Tutorial Session

T1-T2: *Programming Language: Python 1*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)

PYTHON: Python is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C. The language provides constructs intended to enable clear programs on both a small and large scale. Python supports multiple programming paradigms, including object-oriented, imperative and functional programming styles. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library. Like other dynamic languages, Python is often used as a scripting language, but is also used in a wide range of non-scripting contexts. Using third-party tools, Python code can be packaged into standalone executable programs. Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is free and open source software and has a community-based development model, as do nearly all of its alternative implementations. CPython is managed by the non-profit Python Software Foundation. In this session, installation of the operating system UBUNTU & PYTHON is carried out.
T3-T4: *Programming Language: Python 2*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
PYTHON: Python was conceived in the late 1980s and its implementation was started in December 1989 by Guido van Rossum at CWI in the Netherlands as a successor to the ABC language (itself inspired by SETL) capable of exception handling and interfacing with the Amoeba operating system. Van Rossum is Python's principal author, and his continuing central role in deciding the direction of Python is reflected in the title given to him by the Python community, Benevolent Dictator for Life (BDFL). Python 2.0 was released on 16 October 2000, with many major new features including a full garbage collector and support for Unicode. With this release the development process was changed and became more transparent and community-backed. Python 3.0 (also called Python 3000 or py3k), a major, backwards-incompatible release, was released on 3 December 2008 after a long period of testing. Many of its major features have been backported to the backwards-compatible Python 2.6 and 2.7. In this session, use of command prompt and basic command will be taught.

26 June 2013

Lecture 3 (L3)

Title: *Simulation in A&A* Speaker: **Prof. Dr. Binil Aryal**
Affiliation: Central Department of Physics, Tribhuvan University, Kirtipur, Nepal
Abstract: Computational astrophysics refers to the methods and computing tools developed and used in astrophysics research. Like computational chemistry or computational physics, it is both a specific branch of theoretical astrophysics and an interdisciplinary field relying on computer science, mathematics, and wider physics. Computational astrophysics is most often studied through an applied mathematics or astrophysics programme at PhD level. Well-established areas of astrophysics employing computational methods include magnetohydrodynamics, astrophysical radiative transfer, stellar and galactic dynamics, and astrophysical fluid dynamics. A recently developed field with interesting results is numerical relativity. In this talk I will go through the important techniques of computational astrophysics include particle-in-cell (PIC) and the closely related particle-mesh (PM), N-body simulations, Monte Carlo methods, as well as grid-free (with smoothed particle hydrodynamics (SPH) being an important example) and grid-based methods for fluids. In addition, methods from numerical analysis for solving ODEs and PDEs will be also discussed.

Fig. 5 Tutorial session: Tutors are teaching programming language PYTHON.

Lecture 4 (L4)

Title: *Understanding the Universe: Cosmology after PLA NCK (part 2)*
Speaker: **Dr. Ishwaree Prasad Neupane**
Affiliation: CERN, Theory Department, CH-1211 Geneva 23, Switzerland
Abstract: The Planck measurements of cosmological parameters reveal an almost 'perfect universe' with the mass energy density proportion of 68.3% dark energy, 26.8% dark matter and 4.9% ordinary matter, and derive an almost perfect agreement with primordial cosmological inflation. The precision of PLANCK makes it possible to confront theoretical models with data, providing an opportunity to test the inflationary idea and hence to pin down the underlying physics of the early universe. String theory appears to the best candidate for a quantum theory of gravity, so one may hope that some

distinguishing signals of this theory can be revealed in the sky as well. In this talk, I will give an overview of recent attempts made to explore a connection between string theory ideas and the current standard model of cosmology – concordance cosmology.

Tutorial Session

T5-T6: *Programming Language: Python 3*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
PYTHON: Python is a multi-paradigm programming language: object-oriented programming and structured programming are fully supported, and there are a number of language features which support functional programming and aspect-oriented programming (including by metaprogramming and by magic methods). Many other paradigms are supported using extensions, including design by contract and logic programming. The use of inbuild program will be taught.

T7-T8: *Programming Language: Python 4*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
PYTHON: Python uses dynamic typing and a combination of reference counting and a cycle-detecting garbage collector for memory management. An important feature of Python is dynamic name resolution (late binding), which binds method and variable names during program execution. The design of Python offers only limited support for functional programming in the Lisp tradition. The language has map(), reduce() and filter() functions, comprehensions for lists, dictionaries, and sets, as well as generator expressions. The standard library has two modules (itertools and functools) that implement functional tools borrowed from Haskell and Standard ML. Participant will write a code dealing the motion of charged particle in electromagnetic field and the path of the parabola.

27 June 2013

Lecture 5 (L5)

Title: *Kinetic Trajectory Simulation in Astro-plasma*
Speaker: **Dr. Raju Khanal**
Affiliation: Central Department of Physics, Tribhuvan University, Kirtipur, Nepal
Abstract: The presence of a non-negligible number of charge carriers makes the plasma electrically conductive so that it responds strongly to electromagnetic fields. Plasma, therefore, has properties quite unlike those of solids, liquids, or gases and is considered a distinct state of matter. Like gas, plasma does not have a definite shape or a definite volume unless enclosed in a container; unlike gas, under the influence of a magnetic field, it may form structures such as filaments, beams and double layers.

Fig. 6 Tutorial session: Participants are learning programming language PYTHON.

Some common plasmas are found in stars and neon signs. In the universe, plasma is the most common state of matter for ordinary matter, most of which is in the rarefied intergalactic plasma (particularly intracluster medium) and in stars. Much of the understanding of plasmas has come from the pursuit of controlled nuclear fusion and fusion power, for which plasma physics provides the scientific basis. Kinetic models describe the particle velocity distribution function at each point in the plasma and therefore do not need to assume a MaxwellBoltzmann distribution. A kinetic description is often necessary for collisionless plasmas. There are two common approaches to kinetic description of a plasma. One is based on representing the smoothed distribution function on a grid in velocity and position. The other, known as the particle-in-cell (PIC) technique, includes kinetic information by following the trajectories of a large number of individual particles. Kinetic models are generally more computationally intensive than fluid models.

Lecture 6 (L6)

Title: *Numerical Methods in Compulation*
Speaker: **Prof. Dr. Mukunda Mani Aryal**
Affiliation: Central Department of Physics, Tribhuvan University, Kirtipur, Nepal
Abstract: In physics, different theories based on mathematical models provide very precise predictions on how systems behave. Unfortunately, it is often the case that solving the mathematical model for a particular system in order to produce a useful prediction is not feasible. This can occur, for instance, when the solution does not have a closed-form expression, or is too complicated. In such cases, numerical approximations are required. Computational physics is the subject that deals with these numerical approximations: the approximation of the solution is written as a finite (and typically large) number of simple mathematical operations (algorithm), and a computer is used to perform these operations and compute

an approximated solution and respective error. Physics problems are in general very difficult to solve exactly. This is due to several (mathematical) reasons: lack of algebraic and/or analytic solubility, complexity and chaos. For example - even apparently simple problems, such as calculating the wavefunction of an electron orbiting an atom in a strong electric field, may require great effort to formulate a practical algorithm (if one can be found); other cruder or brute-force techniques, such as graphical methods or root finding, may be required. On the more advanced side, mathematical perturbation theory is also sometimes used.

Tutorial Session

T9-T10: *Software Mathematica*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
Mathematica: Mathematica is a computational software program used in scientific, engineering, and mathematical fields and other areas of technical computing. It was conceived by Stephen Wolfram and is developed by Wolfram Research of Champaign, Illinois. Mathematica is split into two parts, the kernel and the front end. The kernel interprets expressions (Mathematica code) and returns result expressions. The front end, designed by Theodore Gray, provides a GUI, which allows the creation and editing of Notebook documents containing program code with prettyprinting, formatted text together with results including typeset mathematics, graphics, GUI components, tables, and sounds. All contents and formatting can be generated algorithmically or interactively edited. Most standard word processing capabilities are supported, but there is only one level of 'undo". It includes a spell-checker but does not spell check automatically as you type.

T11-T12: *Software Mathematica*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
Mathematica: Communication with other applications occurs through a protocol called MathLink. It allows communication between the Mathematica kernel and front-end, and also provides a general interface between the kernel and other applications. Although Mathematica has a large array of functionality, a number of interfaces to other software have been developed, for use where other programs have functionality that Mathematica does not provide, to enhance those applications, or to access legacy code.

28 June 2013

Lecture 7 (L7)

Title: *Database & Data Reduction Technique in A&A*
Speaker: **Prof. Dr. Binil Aryal**
Affiliation: Central Department of Physics, Tribhuvan University, Kirtipur, Nepal
Abstract: The database center (SIMBAD, NED and SkyView) will be introduced and discussed its implications and importance. A method of problem identification will be extensively discussed.

Lecture 8 (L8)

Title: *Cosmology after PLANCK*
Speaker: **Prof. Dr. Uday Raj Khanal**
Affiliation: Central Department of Physics, Tribhuvan University, Kirtipur, Nepal
Abstract: The Planck Satellite has transformed the accurucay of cosmological observations, which allows to constrain cosmological models with unprecedented precision. The Planck observations have far reaching impact on the possible cosmological models and interpretations. This MIAPP workshop "Cosmology after Planck" will bring together observers and theorists to provide a platform for presenting and discussing the Planck Satellite results in the context of cosmological models. In particular we will discuss the polarization measurements, constraints on primordial Non-Gaussianity, the effect and exploitation of CMB lensing, constraints on inflationary models, probes of the reionization history of the Universe, Sunyaev-Zel'dovich galaxy cluster observations and the future of CMB observations.

Tutorial Session

T13-T14: *Software Matlab*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
Matlab: MATLAB (matrix laboratory) is a numerical computing environment and fourth-generation programming language. Developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, and Fortran. Although MATLAB is intended primarily for numerical computing, an optional toolbox uses the MuPAD symbolic engine, allowing access to symbolic computing capabilities. An additional package, Simulink, adds graphical multi-domain simulation and Model-Based Design for dynamic and embedded systems.

T15-T16: *Software Matlab*
(Instructors: Hemanta Bhattarai, Ramesh Pandey, Saroj Dhakal & Saroj Dangi)
Matlab: MATLAB has structure data types. Since all variables in MATLAB are arrays, a more adequate name is "structure array", where each element of the array has the same field names. In addition, MATLAB supports dynamic field names (field look-ups by name, field manipulations, etc.). Unfortunately, MATLAB JIT does

not support MATLAB structures, therefore just a simple bundling of various variables into a structure will come at a cost.

Closing Ceremony

The closing ceremony was chaired by the head of the department, Central Department of Physics, Prof. Dr. Lok Narayan Jha. He distributed workshop certificates to the participants and best poster award to the winner. A sample of conference certificate is shown in Fig. 8.

4 Participants

There were 57 participants including four instructors in the workshop. Six experts namely Prof. Uday Raj Khanal, Prof. Mukunda Mani Aryal, Prof. Binil Aryal, Dr. Raju Khanal of Central Department of Physics, Tribhuvan University, participated actively in the workshop. Guest expert Dr. Ishwaree Prasad Neupane, Scientist, CERN, Theory Department, CH-1211 Geneva 23, Switzerland, delivered two talks and chaired four sessions including two tutorial session in all 4 days. The instructors were Mr. Hemanta Bhattarai, Mr. Saroj Dhakal, Mr. Ramesh Pandey and Mr. Saroj Dhangi. They all are astronomy graduates doing research work with Prof. Binil Aryal as research assistant. A complete list of participants and their affiliation, e-mail address are given in the table 2. There were nine participants who came from outside the capital city, Kathmandu.

The Full form of the abbreviations given in Table 2 are as follows:
CDP: Central Department of Physics
TU: Tribhuvan University
GGIC: Golden Gate International College
PMC: Patan Multiple College
PAS: Pokhara Astronomical Society

5 Poster Session

There were 21 posters contributed by the participants. Out of these, six were original contributions. These posters contains the preliminarily results of the research work in the field of A&A. A list of original contribution is as follows:

1. *A Study of Spatial Orientation of g- Magnitude SDSS Galaxies in the Redshift Range 0.40-0.50* (Robin Mahat)
2. *A Study of Spatial Orientation of u- Magnitude SDSS Galaxies in the Redshift Range 0.05-0.10* (Bhanu Bhakta Regmi)
3. *Two New Far Infrared Nebula at –23 and –31 Degree* (R. Dahal and M. Sitaula)
4. *A Systematic Search of Interacting Pulsar in the IRAS Maps* (Ajay Kumar Jha)
5. *A Systematic Search of Interacting White Dwarf in the IRAS Maps* (Bhanu Bhakta Sapkota)
6. *Distribution of Spin Vector Orientation of Galaxies: Comparison between 7th and 8th SDSS Data Release* (Shiv Narayan Yadav)

In addition there were 15 informative posters prepared by young graduates in the evolving areas of A&A. Eight posters were orally presented. A list of original contribution is as follows:

1. *Faster than Light: Neutrino Anamoly* (Anil Ghimire)
2. *Astronomy Education and Outreach in Western Nepal* (Suman Gautam)
3. *Wormhole a Science Fiction* (K. C. Neupane)
4. *Neutrino Physics: Status, Prospects and Future* (Mahendra Wasti)
5. *A Journey of Approximately 8 Minutes by Solar Neutrinos* (Popular Pandey)
6. *Exoplanet Research and Techniques* (Samir Nepal)
7. *Lab Set Up for Meteor Shower Study* (Riwaj Neupane)
8. *Sloan Digital Sky Survey: Apache Point Obsevatory* (Dev B. Karki, P. Bhattarai, P. R. Bhattarai, P. Pandey)
9. *Study of Flux Emitted from the Outer Surface of Star Sirius* (K. P. Chauhan)
10. *Dark Matter* (Sunil Laudari and Prabha Aryal)
11. *An Insight on Dark Matter and its ongoing Global Quest* (Shiv K. Subedi)
12. *Mysteries from Star to Black Hole Formation and its Spin* (D. R. Upadhayay)
13. *Difficulties with Surfaces and the Robertson-Walker Metric* (Saurav Bhandari)
14. *A Study of Structure and Working of HALE Telescope* (P. Bhattrarai, P. R. Bhattarai and P. Pandey)
15. *Lesson from Eastern Astronomy* (Sunil Laudari)

Dr. Ishwaree Prasad Neupane asked questions to the poster presenters during post lunch session in order to select for the best poster award.

The posters entitled '*A Study of Spatial Orientation of u- Magnitude SDSS Galaxies in the Redshift Range 0.05-0.10*' won the best poster award in the original work category. This poster was prepared by Mr. Bhanu Bhakta Regmi, Central Department of Physics, Tribhuvan University, Kirtipur.

The poster prepared by Mr. Riwaj Neupane, entitled '*Lab Setup for Meteor Shower Measurement*' won best poster award in the informative contribution category. The image of these best posters are shown in Figure 9.

6 Project Outcome

Prime motive of NWAA2013 was to create an interest and motivation towards A&A research in Nepal. The tar-

Table 1 List of NWAA2013 participants. The first column lists the name of the participants. The last two columns give their affiliation and e-mail address.

S.N.	Name	Affiliation	E-mail
1	Ajay Kumar Jha	CDP, TU, Kirtipur	ushaajay2009@rediffmail.com
2	Ajay Paudel	CDP, TU, Kirtipur	azay_poudel@yahoo.com
3	Anil Ghimire	CDP, TU, Kirtipur	ghimire_anil046@hotmail.com
4	Arjun Gautam	M.M. Campus, Nepalgung	arjungautamnpj@gmail.com
5	Bhanu Bhakta Regmi	CDP, TU, Kirtipur	bhanuregmi@yahoo.com
6	Bhanu Prasad Sapkota	CDP, TU, Kirtipur	bhanusapkota45@gmail.com
7	Bhimsen Shrestha	GGIC, Kathmandu	bhattarai_sudhir@yahoo.com
8	Birendra Prasad Pant	St. Xaviers College, Kathmandu	ptbiren@gmail.com
9	Biswash Bhusal	St. Xaviers College, Kathmandu	bhusal_biswash@yahoo.com
10	Buddhi Prakash K.C	St. Xaviers College, Kathmandu	prakeysh_kc@yahoo.com
11	Chandani Rajbahak	CDP, TU, Kirtipur	aryalchand@gmail.com
12	Dev Bahadur Karki	St. Xaviers College, Kathmandu	dev_karki2006@yahoo.com
13	Dev Raj Sadaula	CDP, TU, Kirtipur	joinme342@yahoo.com
14	Devendra Raj Upadhyay	CDP, TU, Kirtipur	mnadphy03@gmail.com
15	Henamta Bhattarai	CDP, TU, Kirtipur	plsignin@hotmail.com
16	Huta Raj Banjade	CDP, TU, Kirtipur	hamro_100@yahoo.com
17	Kamal Kanta Dhungel	CDP, TU, Kirtipur	dhungelakamal33@yahoo.com
18	Keshaw Prasad Chauhan	PMC, Lalitpur	kswchauhan@gmail.com
19	Krishna Chandra Nupane	CDP, TU, Kirtipur	krishna_physics@yahoo.com
20	Lenin Paudel	GGIC, Kathmandu	paudel.lenin@gmail.com
21	Mahendra Sitaula	CDP, TU, Kirtipur	sitaulamahendra@yahoo.com
22	Mahendra Wasti	GGIC, Kathmandu	m_wosti@yahoo.com
23	Manohary Uprety	GGIC, Kathmandu	manu_great@yahoo.com
24	Mitra Prasad Rai	PMC, Lalitpur	nm_rai2002@yahoo.com
25	Mukunda Kumar Acharya	St. Xaviers College, Kathmandu	macharya518@gmail.com
26	Naresh Adhikari	Jwagal, Lalitpur	uniqnaresh@gmail.com
27	Nawesh Raj Hamal	CDP, TU, Kirtipur	lovelyhamal@yahoo.com
28	Nimesh Man Shakya	St. Xaviers College, Kathmandu	shakya_nimesh@yahoo.com
29	Nirajan Paudel	Kaski, Pokhara	hyperhazard@yahoo.com
30	Nisha Budhathoki	GGIC, Kathmandu	nice.nysha@gmail.com
31	Popular Pandey	CDP, TU, Kirtipur	pandey.popular993@gmail.com
32	Prabha Aryal	CDP, TU, Kirtipur	aryalprabha@gmail.com
33	Pradip Dhungana	CDP, TU, Kirtipur	dhungana.p@gmail.com
34	Prakash Pandey	St. Xaviers College, Kathmandu	meprpandey@yahoo.com
35	Prakash Raj Bhattarai	St. Xaviers College, Kathmandu	praku172001@yahoo.com
36	Puskar Bhattarai	St. Xaviers College, Kathmandu	bhattaraipuskar@gmail.com
37	Rabin Dahal	CDP, TU, Kirtipur	rabin_rose22@yahoo.com
38	Rabin Mahat	CDP, TU, Kirtipur	lovelymahat@yahoo.com
39	Rajesh Prakash Guragain	CDP, TU, Kirtipur	rayessprakash@gmail.com
40	Ramesh Pandey	CDP, TU, Kirtipur	panduram466@hotmail.com
41	Riwaj Neupane	ASCOL, Kathmandu	riwajhtd@yahoo.com
42	Rupesh Bhandari	GGIC, Kathmandu	prodigy.rupesh@gmail.com
43	Samir Nepal	GGIC, Kathmandu	sam.nep@gmail.com
44	Santosh Parajuli	ASCOL, Kathmandu	santosh.prj@gmail.com
45	Santosh Gaire	PMC, Lalitpur	sgaire91@yahoo.com
46	Saroj Dangi	CDP, TU, Kirtipur	saroj_225@hotmail.com
47	Saroj Dhakal	CDP, TU, Kirtipur	sawrose_dh@hotmail.com
48	Saurav prasad Bhandari	CDP, TU, Kirtipur	spbhandari2064@yahoo.com
49	Shampa Bhusal	GGIC, Kathmandu	siyasaa@gmail.com
50	Shiv K. Subedi	CDP, TU, Kirtipur	divine.physics@gmail.com
51	Shiv Narayan Yadav	CDP, TU, Kirtipur	ysibnarayan@yahoo.com
52	Subash Adhikari	CDP, TU, Kirtipur	subash1e@hotmail.com
53	Sudhir Bhattarai	GGIC, Kathmandu	bhattarai_sudhir@yahoo.com
54	Suman Gautam	PAS, Pokhara	frenzsuman@gmail.com
55	Sunil Ladauri	CDP, TU, Kirtipur	sunillaudari@yahoo.com
56	Utsav Shrestha	CDP, TU, Kirtipur	mailme_utsav17@yahoo.com
57	Yadav Prasad Kandel	Trichandra College, Kathmandu	kandelypg@gmail.com

Fig. 9 Awarded poster in the 'original work category' entitled '*A Study of Spatial Orientation of u- Magnitude SDSS Galaxies in the Redshift Range 0.05-0.10'* (up) and in the 'informative contribution category' entitled '*Lab Setup for Meteor Shower Measurement*'(bottom).

Fig. 7 Poster session

Fig. 8 Closing ceremony: Prof. Jha is distributing certificates (inset) and Prof. Aryal is concluding the workshop.

get group was the graduate students of Tribhuvan University affiliated degree colleges of Nepal. We achieved following outcome at the end of the workshop:

1. Participants became familiar with the access of freely available database, software and other research materials from the internet for their research work in the future. They have extensively used ADS Database, SIMBAD, NED and SkyView Virtual Observatory during the workshop.

2. Participants became familiar with the data reduction process, plotting, basic statistics, etc using freely available software like IDL, AstroLinux and ALADIN.

3. Participants learned the programming language PYT HON and spend 2 full days leaning PYTHON in the LINUX operating system UBUNTU. This was completely new for all participants. They learned how to write program, how to use in-build programs and how to use available packages in order to solve specific problems.

4. Important software like Mathematica and Matlab were taught in detail. Home assignments and homework were given to the participants. Participants are allowed to share their understandings during tutorial session. The most important thing is that participants new each other and we hope that they will have a close contact among themselves and with their instructors and speakers, which might be important for their future research work.

5. In the future, participants will share their understandings with their colleagues, students in their colleges. A message will be spread among all undergraduate students who wish to carry out research in the field of Astronomy and astrophysics.

7 Conclusions and Recommendation

National workshop on Astronomy and Astrophysics (NW AA2013) is successfully organized at the Central Department of Physics, Tribhuvan University during 25-28 June 2013. NWAA2013 achieved its goal by creating motivation towards A&A research in Nepal. In the concluding session, project leader Prof. Dr. Binil Aryal strongly recommended to organize similar event in the western and eastern region of Nepal. In addition, lecture series on A&A should be conducted in the colleges of small cities (e.g., Biratnagar, Bharatpur, Pokhara, etc) of Nepal. Dr. Aryal highlighted the importance of IAU office of development for Astronomy for offering proposals for 'Astronomy for Universities and Research'.

Fig. 10 Leisure time: participants walking/talking in and around the venue.

8 Acknowledgement

As a project leader Dr. Aryal acknowledge Tribhuvan University, Ministry of S&T of Nepal, International Astronomical Union (IAU), Nepal Physical Society (NPS) and Astrophysics and Cosmology Research Group (ACRG) for their significant support. Dr. Aryal is highly indebted to Kevin Goverder, Director, IAU Office of Astronomy for Development and Dr. Jean-Christophe Mauduit, Project Officer, IAU Office of Astronomy for Development for their constant help, cooperation and timely suggestion. Dr. Aryal gives sincere thanks to the head of the department, Prof. Lok Narayan Jha for his active physical participation during the workshop. Finally, the hero of the workshops were our instructors, Mr. Hemanta Bhattarai, Mr. Saroj Dhakal, Mr. Ramesh Pandey and Mr. Saroj Dhangi. Dr. Aryal highly appreciates their effort, hard work particularly for the tutorials in which their preparation, non-stop delivering skill and cooperative nature greatly helped the participants. They have created such a warm and friendly environment that all the participants gave a big hand to them at the closing ceremony.

References

1. Fundamental Astronomy (5th ed., H. Karttunan et al., Springer, 2007)
2. WMAP Collaboration, Astrophys. J. Suppl. 192, 18 (E. Komatsu et al. 2011)
3. Astronomy & Astrophysics with Elements of Cosmology (V. B. Bhatia, Narosa, 2001)
4. Astrophysical Concepts (4th ed., Martin Harwit, Springer, 2006)
5. Astronomy & Astrophysics (A. B. Bhattacharya et al., Infinity Science Press, 2008)
6. http://www.munich-iapp.de/workshops/workshop-program-2014/cosmology/