A report on the Regional Astronomy Workshop on Astronomy Data Analysis School

07 - 18 November 2016
Copperbelt University (CBU), Kitwe - Zambia

Sponsored by Copperbelt University and the 2015-TF1 Project of the IAU/OAD, Starlight in the university lab : Astrolab.

Submitted by:

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and
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with the participation of:

Dr Michele Gerbaldi (Facilitator)
Institut d'Astrophysique de Paris – France

Dr Sohan Jheeta
Leeds - UK

Patrick Mzaza
Physics Department, Chancellor College
University of Malawi
Zomba – Malawi

Golden Gadzirayi Nyambuya
National University of Science and Technology
Bulawayo - Zimbabwe

Dr Chika Christian Onuchukwu
Chukwuemeka Odumegwu Ojukwu University
Anambra State University, Uli – Nigeria

Dr Sudhanshu Barway, could not attend as his visa could not be obtained.
SAAO - South Africa

1. Background

At Copperbelt University, (CBU, Kitwe – Zambia), the students in Pure Physics and Physics with Education have an Introductory Astronomy course as compulsory at second year of their programme.

For the Physics students from the "School of Mathematics and Natural Science " and from the BSc in Education, Prospery Simpemba set up a 2-week School on Astronomy Data Analysis.
In that context a group of 34 under-graduate students from CBU learned all the steps of data analysis from selecting an eclipsing binary system to be observed with a robotic telescope to the final aperture photometric measurements on CCD images. For each step practical activities were done by the students.

2. Participants

N0	NAME	STUDENT NUMBER	PROGRAMME
1	SILWIMBA KACHINGA	15002657	PURE PHYSICS
2	LUYANDO NG`ANDU	15003772	PURE PHYSICS
3	ALLAN CHIKOLOLO	14471409	PURE PHYSICS
4	BESA SIMUKOKO	15001310	PURE PHYSICS
5	TENTANI JERE	15004265	PURE PHYSICS (passed away on 15th December 2016)
6	MWICHE SIMPEMBA	15006204	PURE PHYSICS
7	EMMANUEL MWAMBA	15003327	PURE PHYSICS
8	KINGSLEY KAPUTO	15001923	PURE PHYSICS
9	ROYD MULONDWA	15003327	PURE PHYSICS
10	MUKUPA PATRICK	15003178	PURE PHYSICS
11	LIGHTON SAKALA	15002263	PURE PHYSICS
12	GIDEON MASITAKI	15002263	PURE PHYSICS
13	KELVIN MWAFULILWA	15004770	PURE PHYSICS
14	SICHILONGO NELSON	15007647	PURE PHYSICS
15	LYOMBE GIFT	15008964	PURE PHYSICS
16	KENNETH SIKOMBE	15001352	PURE PHYSICS
17	MAZUBA KUMWENDA	15004004	PURE PHYSICS
18	SIMFUKWE WILLIAM	15002982	PURE PHYSICS
19	KAUMBA RAPHAEL	15004116	PURE PHYSICS
20	ANDREW BANDA	15001911	PURE PHYSICS
21	MALONGWE WISDOM	15006856	BSc EDUCATION
22	JACKSON MWAPE	15004750	BSc EDUCATION
23	SAM SAMUNETI	15004181	BSc EDUCATION
24	NORAH NAKAUNDA	15005788	BSc EDUCATION
25	GIFT MWAPE	15002929	BSc EDUCATION
26	VICTOR K. MUSONDA	15002208	BSc EDUCATION
27	BRIGHT SIMBEYE	15003246	BSc EDUCATION
28	NEREUS KATUKA	15003803	BSc EDUCATION
29	MWAMBA PAUL	15001331	BSc EDUCATION
30	KANAKANZOVU DOMINI	14346528	BSc EDUCATION
31	MEPHIAS MUSUKWA	15000294	BSc EDUCATION
32	EDWARD MISEBEZI	15005035	BSc EDUCATION
33	PUMULO DERRICK	15008302	BSc EDUCATION
34	KELVIN SIMUPOPO		

3. Acknowledgements

The School needed the use of computers all the time during 2 weeks with a good Internet connection to various professional data base in Astronomy. Our warmest thanks are expressed to the colleagues of the Directorate of ICT at CBU for their help.

The accommodation of the lecturers at Africanza lodge run by CBU has been very much appreciated with the related logistic.

Dr Sohan Jheeta donated a Celestron NextStar Evolution telescope which has already been received at CBU and will be launched on Friday, 23rd December 2016.

4. The context of Astrolab

A research tutorial, Astrolab, is being developed and implemented in universities in need of astronomy infrastructure and curriculum, allowing undergraduate students in sciences to perform real-time observations on a remote telescope, and transforming those observations into a scientific result. This project is a pilot. Presently, the implementation is carried out in three partner universities, Anambra State University in Nigeria, the Copperbelt University in Zambia, and the University of Rwanda.

The goal of this project is twofold:
a) to introduce students to the scientific research method in general by working scientifically through project development and preparation, data acquisition and treatment, analysis and conclusions.
b) to enhance interest in science studies by making them more attractive and getting the students involved in the "learning".
The level is that of science students at an introductory astronomy course (1^{st} or 2^{nd} BSc), but can be adapted downwards as well as upwards.

5. The program

All the activities related to the Astrolab project were developed in all their aspects by the students after a short general presentation by Michele Gerbaldi (hereafter referred as MG). The students were working in groups of 2 or 3. Each group had a direct and continuous follow up by MG and Chika Onuchukwu during the practicals. For each practical a very short written report has to be done by the students.

SCHOOL PROGRAMME

VENUE: E111, COMPUTER LAB 1 and COMPUTER CENTER

WEEK 1: 7-11 NOVEMBER 2016

Monday 7th November 2016

09:00 : Official opening

- Background of the school
- Introduction of guests
- Welcome remarks by the Dean Dr Ng'andwe Mumba

10:00 - 10:00 : Tea break

10:30 - 11:30 : General introduction on the Astrolab tutorial (MG)

11:30 - 12:30 : Binary stars : key stars for direct measurement of stellar masses and radius. (MG)

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : General introduction on CCD color images. Live observation with a robotic telescope in Australia (Helix Nebulae). Comments on the image obtained. How to select a star to be observed in an observatory at a selected date ? (MG)

Tuesday 8th November 2016

09:00 -10:30 : Sohan Jheeta Motivation talk

10:30 -11:00 : Tea Break

11:00 -12:30 : Set up of the practical activities in the Computer Center. Query of a Data Base : CDS (Strasbourg Astronomical Data Center) (MG)

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : Practicals : Query of the data base Vizier at the CDS to select an eclipsing binary.

Wednesday 9th November 2016

09:00 -10:30 : Set up of an observing run: Query of the data base Vizier at the CDS to select an eclipsing binary from a Catalog. Cont. (MG)

10:30 -11:00 : Tea Break

11:00 -12:30 : Practicals : Set up of an observing run : visibility of a star. Query at the Canarian astronomical observatory (iac)

12:30 – 14:00 : Lunch Break

14:00 -16:00 : Query of the Data base Aladin to identify the target on the CCD image as well as the comparison stars. (MG) Practicals on Z Dra and WW Cnc.

Thursday 10th November 2016

09:00 - 10:30 : Telescope : characteristics of a stellar image . CCD Description .
CCD artefects (MG)

10:30 - 11:00 : Tea Break

11:00 - 12:30 : IRIS software : general commands (MG).
Practicals : basics commands applied to the star images Z Dra and WW Cnc.

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : Practicals : measurements on CCD stellar images Z Dra and WW Cnc with IRIS.

Friday 11th November 2016

09:00 -10:30 : Sohan Jheeta : Astrophotography

10:30 - 11:00 : Tea Break

11:00 - 12:30 : Photometry data reduction for variable stars: aperture photometry (MG)

12:30 - 14:00 : Lunch Break

14:00 -16:00 : Practical: aperture photometry on CCD images of WW Cnc

WEEK 2: 14-18 NOVEMBER 2016

Monday 14th November 2016

09:00 - 10:30 : How to take images with a robotic telescope (MG)
Preparation of the observations for each group. (MG)
Practicals : aperture photometric measurements. Live observations with a robotic telescope at MayHill, New Mexico, USA.

10:00 - 10:30 : Tea Break

10:30 - 12:30 : Preparation of the observations for each group. Cont. (MG)

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : CCD data analysis : atmospheric absorption, aperture photometry, differential photometry (MG)
Practicals : differential photometry, PSF and selection of the apertures.
Magnitude measurements in the field of WW Cnc.

Tuesday 15th November 2016

09:00 - 10:30 : Practicals: aperture photometry, automatic measurements in the field of WW Cnc.

10:30 - 11:00 : Tea Break

11:00 - 12:30 : Calibration of CCD images (MG)

Practicals : comparisons between Bias files, Dark files and Flat Field files

12:30 - 14:00 : Lunch Break

14:00 -16:00 : Practicals CCD data analysis with IRIS. Cont.

Wednesday 16th November 2016

09:00 - 10:30 : Planning an observing strategy for observing variable stars (MG)

10:30 - 11:00 : Tea Break

11:00 - 12:30 : Error estimates in differential photometry (MG)

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : Golden Gadzirayi Nyambuya talk : On the polemical Titus-Boode Law.

General discussion

Thursday 17th November 2016

09:00 - 10:30 : Chika Christian Onuchukwu talk : Stellar evolution; general discussion

10:30 - 11:00 : Tea Break

11:00 - 12:30 : The Solar system : planets properties, planet formation exo-planets. (MG).

General discussion

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : Assignment given to the students : each group had to prepare a short presentation on the stellar evolution for the next day.

Friday 18th November 2016

09:00 - 10:30 : Assignments done on stellar evolution by the students.

Selection of the best .ppt and its presentation.

Assignment given to the students for the next term : to define the observational dates in December 2016 and January 2017 of the two eclipsing binaries AM Aur and RY Aur in order to built their light curve, observations to be done at Mayhill Observatory, New Mexico, USA

General discussion on this 2-week School led by Patrick Mzaza

(see the document below, Section 7)

10:30 - 11:00 : Tea Break

11:00 - 12:30 : Closing ceremony by the Dean Dr Ng'andwe Mumba,

a certificate being given to each student.

12:30 - 14:00 : Lunch Break

14:00 - 16:00 : Talk by Michele Gerbaldi for the School of Mathematics and Natural Science :

Gaia : The dream of the Astronomers, the Milky Way in 3-D.

6. School achievements

The pdf files of the complete description of the Astrolab project were given to all participitants :.pdf files of lectures, .ppt files of all the presentation as well as .pdf files of the exercises.

All the lectures on Astrophysical topics were followed by numerous questions from the students, eager to learn more and more from the lecturers.

7. Conclusions and Recommendations

A survey of the School was set up by Patrick Mzaza through a detailed discussion with the participants. The conclusions are:

Strengths	Weaknesses/Areas to improve
1. The workshop was inspiring due to the knowledge of the presenters - presenters were able to provide detailed explanations and could answer all questions effectively 2. The presenter (Dr. Michele) was very active despite her age 3. The workshop has improved students' knowledge and skills in research 4. Food was provided (tea and snacks) which made students follow the presentations effectively 5. Donation of the telescope which will help students in making observations 6. The workshop has helped students to gain knowledge and skills in using soft-wares such as Iris	1. No handouts were provided – handouts would have made the students follow the presentations easily 2. The students were not effectively directed and assisted as mostly was only Dr. Michele who would go round helping the students in their groups 3. Lack of a variety of presenters – There was a need of a variety of presenters as this arouses the interests in following the activities due to the variations in approaches by different presenters. 4. Installation of soft-wares and materials on computers while the sessions were in progress – all necessary soft-wares and materials should have been uploaded well before the sessions start to save time. 5. Insufficient assignments – there was a need to provide enough assignments as assignments/activities keep the learners/audience active as they work on the assignments/activities. 6. Ascents of the presenters – the ascents of some presenters posed a challenge for some students to effectively follow the presentations. 7. Lack of time management – time was not well managed as presentations could go beyond the normal lecturing time (16 hrs)

To maintain continuity in the use of Astrolab for teaching, it may be better to organize another workshop with the main target being the tutors, who will then continue with the program at their respective school.

Participants and lecturers at the Copperbelt University – Kitwe.

General discussion during the workshop

A tutorial by Chika Christian Onuchukwu during the worshop.

A tutorial by Michele Gerbaldi during the worshop.