

# DEPARTMENT OF PHYSICS

## ANNUAL REPORT 2013

### 1. INTRODUCTION

The Department of Physics is one of the oldest departments of the University of Nairobi. It was established in 1956 when the Royal Technical College of East Africa started offering an A-level course in Physics. In 1961, the Royal Technical College became the Royal College, Nairobi, offering degrees of the University of London. The Royal College, Nairobi became the University of East Africa, Nairobi Campus in 1963. The University of Nairobi gained autonomous university status in 1970. In the early days, the department was located at the Main Campus in the present Hyslop building. The department moved to its present location in Chiromo in 1974. The Department of Physics had its first batch of physics students (six in number) in 1966.

We also offer service courses to School of Computing and Informatics, Department of Chemistry, the College of Architecture and Engineering, College of Education and External Studies and the College of Agriculture and Veterinary Sciences.

### 2. PROGRAMMES OFFERED

The following undergraduate (B.Sc.) and postgraduate (M.Sc. and Ph.D) programmes are offered:

#### Undergraduate degree courses

- B.Sc. in Physics
- B.Sc. in Microprocessor Technology and Instrumentation
- B.Sc. in Astronomy and Astrophysics

#### Postgraduate degree courses

- M.Sc. in Physics
- Ph.D. in Physics

### 3. ENROLLED STUDENTS

i. Undergraduate	162
ii. Postgraduate	
M.Sc.	31
Ph.D.	13

The students taught in the service courses in other departments, schools and colleges stand at about 1000.

### 4. INTERNATIONAL STUDENTS

Currently, The Department does not have enrolled international students. However, the Department hosted the following students on research visits:

1. Mr. Austine Mulama, M.Sc. Student, Maseno Univesity (Three months)
2. Mr. J. P. Eneku, Ph.D. Student, Makerere University (Two months)
3. Mr. M. G. Asiimwe, M.Sc. Student, Makerere University (Two months)

## 5. RESEARCH ACTIVITIES UNDERTAKEN

The following are the research groups in physics

- I. Condensed Matter Physics
- II. Applied electronics
- III. Geophysics
- IV. Laser Physics and Spectroscopy
- V. Applied Nuclear and Radiation Physics
- VI. Theoretical physics

### (a) Condensed Matter Physics

Condensed Matter Physics, is a thematic group headed by Prof. Bernard O. Aduda. This branch of physics deals with properties of matter, and is notably the largest field of contemporary physics. It studies "condensed" phases that occur when the number of constituents in a system is very large and the interactions between the constituents are strong. Examples of condensed matter are solids and liquids where the bonding between the atoms are mainly electromagnetic in nature.

During the year 2013 studies on dye sensitized solar cells were done with focus on:

1. Preparing and characterizing the photoactive electrode ( $\text{TiO}_2$ ) by (a) oblique angle reactive sputtering deposition (b) nitrogen doping and observing how such  $\text{TiO}_2$  photoelectrodes prepared by PVD or doped perform compared to the sol-gel prepared photoelectrodes.
2. Identifying natural anthocyanin dye containing plants, extracting and synthesizing, and purifying the dye for use as an alternative to the costly ruthenium based dye. The charge transfer dynamics of this dye will be studied, plus its stability and adsorbing behaviour.
3. Fabricating and characterizing an ETA solar cell, particularly morphological characterization, structural analysis, optical characterization of  $\text{TiO}_2$ ,  $\text{In}(\text{OH})_x\text{S}_y$  and  $\text{PbS}$  thin films, photoluminescence of  $\text{In}(\text{OH})_x\text{S}_y$ , electrical characterization of the solar cell, and surface photovoltage characteristics of the thin films.
4. Fabricating and characterizing a DSSC solar cell with the  $\text{TiO}_2$  surface modified with a buffer layer.
5. Studying of the charge transport characteristics of thin films prepared by different technique (Electrophoretic deposition (EPD), sputtering and sol-gel techniques)
6. Attempting theoretical models of the DSSC based on our experience.
7. Constructing prototype DSSC/ETA cells resulting from our studies.
8. Building a local pool of talent in solar cell technology.

The group also organized a successful the 3<sup>rd</sup> and 4<sup>th</sup> solar academy in April and August 2013, respectively. This followed the training that begun in 2012 with the 1<sup>st</sup> and 2<sup>nd</sup> held in April and August respectively. Some of the November 2013 solar academy participants are shown in the above image.

### **(b) Applied Electronics**

This thematic area headed by Mr. Mjomba Kale combines the methods from physics, computing and electronics to study and fabricate electronic devices. The areas of interest include;

#### **1. Distributed embedded platform (group main project)**

- Aim is to create an infrastructure that allows quick integration of transducers, computing platforms and communication networks such as wireless sensor networks, mobile networks or the internet.
  - This will provide diverse capabilities such as remote monitoring, control and automation.
2. Digital function generator (M.Sc)
  3. Digital Oscilloscope (M.Sc.)
  4. Automated detection of malaria parasites from blood slides (M.Sc.).
  5. Multiple current and voltage channels digital meters
  6. A low cost high efficiency LED lamp
  7. University of Nairobi Integrated Services – Zigbee based integration of the physical environment to the UON intranet.

### **(c) Applied Nuclear & Radiation Physics**

This group headed by Dr. K. H. Angeyo focused their research on;

1. Medical elementology and spectral diagnosis of disease;
2. Radiometric geothermics; Spectroanalytical environmentrics;
3. Material analysis by chemometric spectroscopy;
4. Radiometric beam quality characterization;
5. Gamma ray spectrometry and detector efficiency modelling.

### **(d) Laser Physics, Spectroscopy & Imaging**

The group whose head is Dr. K. Kaduki carries out research and development on laser spectroscopy methods, optical imaging, instruments and applications. Currently their research is on;

1. Laser and spark produced dense plasmas diagnostics and modelling;
2. Tuneable diode laser spectroscopy applied to trace gas monitoring;
3. Application of LED multispectral imaging microscopy to malaria diagnosis;
4. Development of efficient image recognition algorithms with application to malaria diagnosis;
5. Radiative characterization of atmospheric aerosols using Sun Photometry;
6. Quantitative analysis of trace atomic and molecular signatures of HBRA geothermal matrices by chemometrics assisted LIBS;
7. Monitoring aquatic plants proliferation in Lake Victoria using satellite data.

### **(e) Geophysics**

The area covers integrated geophysical studies of the rocks and sediments of Kenya. It includes the explorations of minerals, geothermal reservoirs, nuclear minerals and their environmental radiations hazards. It is headed by Prof. J. P. Patel and their current research areas include;

1. Gravity and Magnetic Investigation of Greater Magadi Area.

Research work in progress to explore possibility of finding geothermal reservoirs in Magadi area using magnetic and gravity parameters.

2. **“Integrated Geophysical Study of the Southern Kenyan Coastal Sedimentary Rocks of**

## **Kenya”**

Project involves the nuclear geophysical study of the Mrima and Jombo areas sediments for the qualification of nuclear minerals in the area.

### **3. Paleomagnetic Study of the Rocks from Mt. Kenya and Environment**

This is a joint study with the University of Florida and University of Nairobi. It involves the assessment of the past magnetic field of the Earth during the last five million years.

### **4. Nuclear Geophysical Study of Carbonatite Rocks in South Western Kenya**

The research involves use of nuclear techniques in the quantity assessment of nuclear elements in carbonatite rocks from the south western Kenya. The area includes Homa Mountain, Ruri Hills, Rangwe Complex and all the gold mining Migori-Transmara complex.

### **5. Radioactive Minerals in Coumbite-Tantalite (Coltan) Ores in Ruanda**

This is an overseas project in Ruanda. It involves the assessment of nuclear elements in coltan currently mined ores in Ruanda.

## **(f) Theoretical physics**

Theoretical Physics is a branch of physics which is a multi-disciplinary; it includes nearly all branches of physics. It is headed by Prof. Joseph O. Malo. They carry out diverse research including;

1. Studies on neutrino mass at finite temperature;
2. Inflationary Cosmology;
3. Baryogenesis and the Big bang Nucleosynthesis;
4. Cosmic Microwave Background Radiation;
5. Hubble's Law and the Expansion of Space;
6. FLRW Metric; Friedman – Lemaitre, Robertson-Waker Metrix;
7. Galaxy Formation in the BB Theory;
8. Physics at the Earliest Instant of time;
9. Extrapolation of the Universe Backward in Time;
10. Dark Matter and Dark Energy;
11. Cosmological Horizon (past and future);
12. Galactic evolution and distribution – Large Scale Structures of the Cosmos;

## **6. INTERNATIONAL LINKS AND COLLABORATION**

- Uppsala University, Sweden
- Lund University, Sweden
- Air Force Research Laboratory/Institute for Scientific Research (Boston College), USA
- Stanford University Solar Center, USA
- University of Rome (La Sapienza), Italy
- Space Environment Research Centre, Kyushu University, Japan

## 7. COMMUNITY RESPONSIBILITY

The Department of Physics, from time to time, welcome high school students to visit. The students are given a full tour to the various laboratory facilities available with presentations by the technical



*Some of the Mukaa Boys Secondary School students being taken through a demonstration in a physics lab.*

staff responsible of the facilities. This is an important role of the department in triggering interest of science in students while they are still in high school. Students need exposure to institutions of higher learning and the various courses available later on in life, as well as a glimpse of the requirements to joining those courses. When they make this visits, such knowledge is passed across right at the source with first hand experience to the study environment. Some of the recent visits were from Gataragwa Girls Secondary School, on 15th May and Mukaa Boys Secondary School on 7th June 2013 this year.

## 8. CONSULTANCIES UNDERTAKEN

Consultancy on Data Analysis Customer Care Course at UON. Value Ksh.350, 000.00. Participants Involved- Department of Physics through Dr. Musembi, and Ministry of Higher Education Science and Technology (Period July 2012 – July 2013).

## 9. NUMBER OF STAFF

**(a)Teaching**  
Professors

4

Associate professors	1
Senior Lecturers	6
Lectures	11
Tutorial fellows	10
Part-time lecturers	12

**(b) Non-teaching staff** 21

## 10. EVENTS, MEETINGS AND CONFERENCES

A number of events took place within the year 2013 at the physics department. These included

1. The solar academy organized by the condensed matter group in April and August 2013.
2. ANSOLE Workshop, May 2013
3. The Network for Astronomy School Education(NASE) and Square kilometer Array (SKA) international workshop organized in November 2013.
4. The Department hosted Material Science and Solar Energy for Eastern and Southern Africa (MSSEESA) *two activities*:
  - Technical Training in Instrumentation Workshop held on 26 – 27 November 2013 **at the Department of Physics** targeting the technical staff working within the MSSEESA network universities. The main aim was training the technicians in instrumentation and interfacing of equipment. This is part of MSSEESA objective in dissemination and exchange of information. The workshop attracted 15 participants from Kenya, Uganda, Tanzania and Uganda.
  - 1st Young Scientist MSSEESA Conference on Materials Science and Solar Energy Technology held on 28– 29 November 2013 **at the United Kenya Club**. The participants were only drawn from MSSEESA participating nodes. The participants got an opportunity to interact and exchange ideas in their areas of research. This was also an opportunity for the Young Scientist to learn from senior scientists from other regions within the MSSEESA network. The conference attracted 70 participants from Kenya, Uganda, Tanzania and Zambia.



*Some of the November 2013 solar academy trainees learning how to install a solar panel.*



*The 2013 MSSEESA delegates at the Kenya United club*

1. Victor Katontwo (I39/1990/1990/2011) a third year B.Sc. (Microprocessor Technology and Instrumentation) competitively won a Chinese Ambassador Scholarship in November 2013 through the Special Student Advisor office at the University of Nairobi. Mr. Katonto is a partial orphan from a poor background in Pokot County.
2. Ten staff members comprising of both academic and Technical participated in a two week Tailor Made Training in Photovoltaics from 10-24<sup>th</sup> November 2013 at the Deft University of Technology in Netherlands.

#### **11. NUMBER OF GRADUANDS**

• PhD.	2
• M. Sc.	1
• B.Sc. (Microprocessor Technology and Instrumentation):	15
• B.Sc in Astronomy and Astrophysics:	12
• B.Sc. (Physics):	14

#### **12. PUBLICATIONS**

##### **Journal Publications**

The year 2013 saw a number of Journal publications done by our staff and students as listed below.

1. II. Yakub, A. Plappaly, M. Leftwich, K. Malatesta, K. C. Friedman, S. Obwoya, F. Nyongesa, A. H. Maiga et al, *Porosity, flow and filtration characteristics of frustrum-shaped ceramic water filters*, Journal of Environmental Engineering, V. 139, pp. 986-994, July 2013.
2. Musembi R, Aduda B, Mwabora J., M. Rusu, K. Fostiropoulos, M. Lux-Steiner, *Light soaking induced increase in conversion efficiency in solar cells based on In(OH)<sub>x</sub>Sy/Pb(OH)<sub>x</sub>Sy*, Materials Sciences and Applications, V.4, 718-722, November 2013.
3. Otakwa, R. V. M., Simiyu, J. and Mwabora, J. M., *Dye sensitized and amorphous silicon photovoltaic devices' outdoor performance: a comparative study*, International Journal of Emerging Technology and Advanced Engineering, V.3, (7),pp 532, July 2013.
4. P. M. Mukhono, K.H., Angeyo , A. Dehayem-Massop, K. A. Kaduki, *Laser induced breakdown spectroscopy and characterization of environmental matrices utilizing multivariate chemometrics*, Spectrochimica Acta Part B, V. 87, Pp. 81-85, 1 September 2013.
5. Musembi R, Aduda B, Mwabora J., M. Rusu, K. Fostiropoulos, M. Lux-Steiner, *Effect of*



- recombination on series resistance in eta solar cell modified with In(OH)<sub>x</sub>Sy buffer layer*, International Journal of Energy Engineering, V. 3(3), pp. 183-189, 2013.
6. Otakwa R.V.M., Simiyu J., Mwabora, J.M., *Dye-Sensitized and Amorphous Silicon Photovoltaic (PV) Devices' Outdoor Performance: A Comparative Study*, International Journal of Emerging Technology and Advanced Engineering, V. 3(7), PP. 532 -538, July 2013.
  7. C.O. Ayieko, R. J. Musembi, S. M Waita, B. O. Aduda and P. K. Jain, *Perfomance of TiO<sub>2</sub>/In(OH)<sub>i</sub>Sj/Pb(OH)<sub>x</sub>Sy Composite ETA Solar cell fabricated from nitrogen doped TiO<sub>2</sub> thin film window layer*, International Journal of Materials Engineering, V.3(2), pp.11-16, 2013
  8. D. Otwoma, J. P. Patel, S. Bartilol and A. O. Mustapha, *Estimation of annual effective dose and radiation hazard due to natural radionuclides in Mt Homa, southwestern kenya*, Radiation Protection Dosimetry, pp. 1-8, 2013.
  9. B. V. Odari, M. Mageto, R. Musembi, H. Othieno, F. Gaiho and V. Muramba, *Optical and electrical properties of Pd doped SnO<sub>2</sub> thin films deposited by spray pyrolysis*, Austrian journal of basic and applied sciences, V. 7 (2), pp. 89-98, 2013.
  10. B. V. Odari, M. Mageto, R. Musembi, H. Othieno, F. Gaiho M. Mughendi and V. Muramba, *Optoelectronic properties of F-co-doped PTO thin films deposited by spray pyrolysis*, American Journal of material science, V.3(4) pp. 91-99, 2013.
  11. Musembi R, Aduda B, Mwabora J., M. Rusu, K. Fostiropoulos, M. Lux-Steiner, *Effect of recombination on series resistance in eta solar cell modified with In(OH)<sub>x</sub>Sy buffer layer*, International Journal of Energy Engineering, V. 3(3), pp. 183-189, 2013.
  12. Catherine K. Kianji, Njeri W. Kaniaru, Philip K. Mutai and Julius M. Mwabora, *Importance of Law and Lolicy on successful utilization of nuclear Technology for electricity generation*, proceedings of 2013 mechanical engineering conference on sustainable Research and Innovation, V. 5, pp. 82-90, 2013.
  13. Lilian N. Matu and Julius M. Mwabora, *The role of Communication in a Nuclear power programme*, proceedings of 2013 mechanical engineering conference on sustainable Research and Innovation, V. 5, pp. 156-159, 2013.

## **Papers / lectures presented at conferences / workshops**

1. Alex Ogacho, Abdelhak Belaidi, Th. Dittrich, Robinson J. Musembi, and Bernard O. Aduda, *Surface Passivation of Ultrathin Nanoporous TiO<sub>2</sub> for Photovoltaic Application*, Workshop on Material Science for Energy Conversion, iThemba Labs Cape Town, S. Africa 4<sup>th</sup> – 8<sup>th</sup> November 2013.
2. Ajuoga, A. Ogacho, J. Mwabora and B. Aduda, *Niobium doped TiO<sub>2</sub>(Nb:TiO<sub>2</sub>): Effects of doping concentration on the optical properties of TiO<sub>2</sub>*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013.
3. M. Kineene, J. Simiyu, M. Munji *Synthesis and characterization of Niobium Oxide thin films for DSSC application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013.
4. Simiyu J., *Sizing a stand alone photovoltaic electrical solar system for domestic application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013.
5. J.G. Mbae, M. Munji, R.J. Musembi., *Analysis of optimized Deposition temperature of Zn:Al thin film on SnxSeyZnO:AlP-N junction solar cell*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013.
6. B. K. Mutange, P. M. Karimi, R.J. Musembi, D. M. Wamwangi, *Characterization of Indium doped Tin Selenide (In:SnxSey) Thin films for phase change memory application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013
7. A.K. Mulu, P. M. Karimi, R.J. Musembi, D. M. Wamwangi, *Characterization of Tin doped Antimony Selenium (Sn:SbxSe1.5x) Thin film for phase change memory applications*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013.



8. J.Ndungu, F.W. Nyongesa, A.A. Ogacho, B.O. Aduda, *Nanoporous ceramics for Water Filtration*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya. 28-29 November 2013.
9. R .O. Onchuru, M. K. Munji and R.J. Musembi, *Fabrication and characterization of  $TiO_2/In(OH)xSy/SnS$  Composite ETA solar cell*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
10. N. Mugambi, M. Munji, R.J. Musembi, *Characterization of  $SnxSey/SnO_2:Ni$  P-N junction prepared by spray pyrolysis for photovoltaic application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
11. C.K. Wangati, W. Njoroge, P.K. Karanja, J.M. Mwabora, R.J. Musembi, J. Simiyu, *Deposition and characterization of  $CuAl_xB_{1-x}Se_2$  thin film deposited by DC-RF Co-sputtering for photovoltaic application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
12. R.G. Gitonga, R.J. Musembi M. Munji, *Characterization of  $SnxSey/SnO_2:Co$  P-N junction deposited by spray pyrolysis for photovoltaic application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
13. R.V.M. Otakwa, J.M. Mwabora, and J. Simiyu, *The complementarity of Dye-sensitized and amorphous Silicon photovoltaics in field application in the tropics*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
14. S. Nyaga, J. Simiyu, M. Munji, *Projection for PV sizing for a stand alone "all direct current" Telecommunication system using mismatch factor algorithms*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
15. P. Kabuga, W. Njoroge and J. Simiyu *Optical characterization of compounds for dye-sensitized solar cell applications*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
16. V. Muramba, M. Mageto, F. Gaitho, V. Odari, R. Musembi, J. Simiyu, J. Mwabora, *Preparation and Characterization of transparent and conducting doped Tin Oxide*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
17. A. Alfred, J.M. Mwabora, R.J. Musembi, S.M. Waita, *Effects of oxygen partial pressure and substrate temperature on optical properties of sputter deposited  $CuCrO_2$  thin films*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
18. P. V. Mwonga, N. W. Makau, G. O. Amolo, S. Lutta, M. D. O. Okoth, J.M. Mwabora, R.J. Musembi, C.M. Maghanga, R. Gateru, *Ab-initio Studies of point defects in  $TiO_2$ : A density functional approach* 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
19. M.N. Muendo, M. Munji and J. Simiyu, *Characterization of  $TiO_2$  based Dye-sensitized solar cell prepared by screen printing method*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
20. P.M. Mwathe, R.J. Musembi, M. M. Munji, B.V. Odari, *Optoelectronic properties of Palladium doped Tin(IV) oxide ( $Pd:SnO_2$ ) thin films deposited by spray pyrolysis*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
21. M.G. Asiimwe, T. Otiti, J.M. Mwabora *Optical and electrical properties of Magnesium Doped Zinc Oxide for photovoltaic applications*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
22. Njogu S M, *Fabrication and characterization of Germanium Doped Titanium Dioxide ( $Ge:TiO_2$ ) thin film for photovoltaic application*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
23. J. N. Nguu, F W Nyongesa, R. J Musembi, B.O.Aduda, *Morphological and structural characterization of  $TiO_2/Nb_2O_5$  composite electrode thin films synthesized by electrophoretic deposition (EPD) technique*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
24. J.P. Eneku, Otiti Tom, J.M. Mwabora, *Fabrication and characterization of Aluminium and Gallium mono and Co-doped Zinc Oxide thin films by radio frequency sputtering for photovoltaic applications*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United

- Kenya Club, Kenya, 28-29 November 2013.
25. S. R. Tsisambo, M.K. Munji, R.J. Musembi, *Optical and electrical characterization of Cd<sub>x</sub>Ni<sub>1-x</sub>S and Sb<sub>2</sub>S<sub>3</sub> thin films for photovoltaic applications*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
  26. S. Ndonge, R.J. Musembi, M.K. Munji, *Effect of substrate deposition temperature on the properties of Sn<sub>x</sub>Se<sub>y</sub>/ZnO:Sn*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
  27. C.O. Ayieko, B.O. Aduda, R.J. Musembi, S.M. Waita, P.K. Jain, *Performance of TiO<sub>2</sub>/In(OH)<sub>x</sub>Sy composite eta solar cell fabricated from nitrogen doped TiO<sub>2</sub> thin film window layer*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
  28. P. K. Nyaga, R. J. Musembi and M. K. Munji, *Effect of Sn Doping on the electrical properties of as prepared and annealed ZnO thin films prepared by Reactive evaporation*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
  29. D. Magero, N. W. Makau, G. O. Amolo, S. Lutta, M. D. O. Okoth, J.M. Mwabora, R.J. Musembi, C.M. Maghanga, R. Gateru, *Hydrogen as an alternative fuel: An ab-initio study of Lithium Hydride and Magnesium Hydride*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
  30. V. K. Mengwa, N. W. Makau, G. O. Amolo, S. Lutta, M. D. O. Okoth, J.M. Mwabora, R.J. Musembi, C.M. Maghanga, R. Gateru, *A density functional theory study of electronic structure of TiO<sub>2</sub> Rutile (110) surfaces with cathechol adsorbate*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
  31. B.V. Odari, R.J. Musembi, M.J. Mageto, H. Othieno, F. Gaitho, M. Mghendi, V. Muramba, *Optoelectronic properties of F-co-doped PTO thin films deposited by spray pyrolysis*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
  32. B.V. Odari, M. Mageto, R. Musembi, H. Othieno, F. Gaitho, V. Muramba, *Optical and electrical properties of Pd Doped SnO<sub>2</sub> thin films deposited by spray pyrolysis*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013.
  33. W. Mulwa, N. W. Makau, G. O. Amolo S. Lutta, M. D. O. Okoth, J.M. Mwabora, R.J. Musembi, C.M. Maghanga, R. Gateru, *Structural and electronic properties of TiO<sub>2</sub>, Nb:TiO<sub>2</sub> and Cr:TiO<sub>2</sub>: A first principles study*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
  34. A. A. Mulama, J.M. Mwabora, A.O. Oduor, and C. Muiva, *Optical properties of flash evaporated Se<sub>100-x</sub>Bi<sub>x</sub> thin films: Effects of film thickness*, 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
  35. L. K. Munguti, R.J. Musembi, W.K. Njoroge *Optimization of Sn<sub>x</sub>Se<sub>y</sub> Deposited by reactive thermal evaporation for solar cell, application*. 1<sup>st</sup> Young Scientists' MSSESA Conference on Material Science and Solar Cell Technology, United Kenya Club, Kenya, 28-29 November 2013
  36. Kaduki K, *Physics at the university of Nairobi*, High level physics and appropriate solutions to real life problems in developing countries, Yaounde, Cameroon, 25-29 November 2013
  37. Dehayem-Massop, *Research activities in Physics in East Africa*, High level physics and appropriate solutions to real life problems in developing countries, Yaounde, Cameroon, 25-29 November 2013
  38. Birech Z., *Ultrafast dynamics of excited states in molecular crystals: The case of tetracene ultrathin single crystals*, 6th ALC student workshop 2013, Zevenwacht wine estate, Cape town, South Africa, 21-24 November 2013.
  39. Angeyo H, Kaduki K, Dehayem-Massop, *Trace quantitative and exploratory analysis by multivariate chemometric laser induced breakdown spectrometry applied to malaria and radiogeothermal diagnostics*. RIAO/OPTILAS 2013 VIII Iberoamerican Conference on Optics and XI Latin-American Meeting on Optics, Lasers and Applications, Porto, Portugal, July 22 - 26, 2013
  40. Angeyo H, Dehayem-Massop, Kaduki K, *Development of laser education and research towards biophotonics at Nairobi*. 12th International Conference on Education and Training in Optics and Photonics, Porto, Portugal, July 23 - 26, 2013.
  41. Birech Z. *Types of laser sources and their applications*, ALC workshop, ARC Hotel, Egerton university, Kenya, 08-13 September 2013.
  42. Silas Mureramanzi, *An investigation on the output stability and properties of photovoltaic PEC cells*

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