

The Scientific Program of ACP2021

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Virtual Event



**Second African Conference on
Fundamental and Applied Physics
ACP2021**

Book of Abstracts

Contents

Welcome address – Cadi Ayyad University in Marrakesh	1
Welcome address – Mohammed V University in Rabat	1
Science bridging Cultures and Nations	1
Introduction to the African Strategy for Fundamental and Applied Physics (ASFAP)	1
Status and Impact of Particle Accelerators in Africa	2
An Astrophysics Journey from the Kalahari to the Edge of the Universe	2
An Assessment of Atomic and Molecular Physics in Africa	2
Road to SDG5: Role of Women in Astronomy and Physics for African Growth	3
Status of Young Physicists Forum and the Importance for Education and Capacity Development for Africa	3
On making physics relevant to society in general and to scientists in particular: Closing the epistemic gap	4
The African Biophysics Landscape	4
An introduction to quantum computing and quantum information	4
Physics of the Earth	5
Physics education for capacity development and research in Africa	5
African Energy Access and Development: Situation and Research State of the Art	6
Status and Impact of Fluids and Plasma Physics for Education and Capacity Development in Africa	6
Light sources for capacity building and research in Africa	6
Condensed Matter and Materials Physics Capacity building and Research for African Development	7
Welcome address	7
The African School of Fundamental Physics and Applications (ASP)	7
ASP2022 – South Africa	8

ASP Discussion	8
Vote of Thanks	8
STEM Capacity Building Strategies for African Development	9
Physics Research Strategies for African Development	9
Panel Discussion – Theme: Physics education and research roadmap development and implementation in Africa	9
Nuclear Physics in Africa – Education, Research and Challenges	9
On Particle Physics, ASFAP and Education in Africa: Status and Challenges	10
Solar Powered Radiotherapy in Africa	10
Laser Research in Africa	11
ASFAP Working Group Summary of Societal Engagements	11
ASFAP Working Group Summary of Light Sources & Applications	12
ASFAP Working Group Summary of Particle, (Astro)particle physics & Applications	12
ASP COVID-19 Data Analysis Results	12
IEEE Nuclear and Plasma Science Society	13
ASFAP path forward & Feedback from IAC	13
APS Forum on International Physics (FIP)	13
Feedback from UNESCO	13
Discussion on Societal Engagements: Community Engagement, Young Physicists, Women in Physics and Physics Education	14
Joint Session on Light Sources and Applications: Light Sources, Accelerators, biophysics, Earth Science, Atomic & Molecular, Condensed Matter & Materials Physics, Optics & Photonics, Energies, Instrumentation, and Computing	14
Particles and Applications: Accelerators, Particle Physics, Nuclear Physics, Medical Physics, (particle)Astrophysics & Cosmology, Fluid & Plasma, Complex Systems, Instrumentation & Detectors, Computing, and Nuclear Energy	14
Determination of the thickness and optical properties by reflectance method	15
Structural, electronic and optical properties of CN, C ₂ N ₂ and C ₄ N ₂ nanotubes resulting from N-doping small (3,3) SWCNT : A DFT study	15
Electron-phonon and Spin orbit coupling in transition metal dichalcogenides quantum dot after short pulse excitation under magnetic field	15
Density functional study of conductive organic polymers derived from PPE-PPV	15
Effect of chemical composition on the structure and dielectric properties of pure and doped Al ₂ O ₃ -ZrO ₂ composites	15

Gamma-ray mass attenuation coefficient of environmentally friendly Bi _{0.5} Na _{0.34} K _{0.11} Li _{0.05} Ti _{1-x} Ni _x O ₃ ceramics	15
A High-Granularity Timing Detector (HGTD) in ATLAS Phase-II Upgrade: Physics and performance with HGTD	16
Minimum bias simulation of parasitic collisions	16
Search of new resonances decaying into top quark pairs in the lepton+jet final state in proton-proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector	16
Search for charged Higgs boson via $H^\pm W^\mp$ at the LHC	16
Search for invisible Higgs bosons produced via vector boson fusion (VBF) at the LHC using the ATLAS detector	16
Structural and Optical proprieties of Cu _x S deposited by flash evaporation	17
Structural analysis and band gap engineering of 2D perovskite Cs ₂ XAg(I _{1-x} Br _x) ₆ for solar cell applications using DFT method	17
Properties of the structure, electronics and opticals of AB and AA stacking bilayer graphene intercalated by Sr atom	17
Structural, Electronic and Optical parameters of Zn ₂ VN ₃ Compounds by Density functional theory	17
Preparation and characterization CNCTS thin films for solar cells without a sulfurization step	17
Structural, elastic, thermodynamic, electronic, optical and thermoelectric properties of lead-free double perovskites Cs ₂ NaBiX ₆ (X= Cl, Br, I) from ab-initio calculations	17
Extended Higgs sector of 2HDM with real triplet : Theoretical and phenomenological studies at the LHC	18
Measurement of azimuthal angular correlations of D mesons with charged particles in pp collisions at $\sqrt{s} = 13$ TeV with ALICE at the LHC	18
3-Dimensional BF Theory On Seifert Fibered Manifolds	18
Multiplicity dependence of heavy-flavour production in small systems in ALICE	18
Light charged Higgs boson decays to a W^\pm and a BSM Higgs boson at the LHC	19
D-meson Suppression and Azimuthal Anisotropy in a Strongly Coupled Plasma at $\sqrt{s_{NN}} = 5.5$ TeV with Comparison to LHC Measurements	19
On the DDM and ML quantum concepts in nuclear shape phase transitions of atomic nuclei	19
Using Microphotonic Nuclear Forensics to Mediate Nuclear Security and Nuclear Safety	19
Soil gas radon, indoor radon and its diurnal variation in Northern region of Cameroon	19
Evaluation of whole body dose absorbed by Geant4 simulation	19

Monte Carlo Simulation of the Biograph mCT PET scanner using GATE	20
The African Light Source	20
Investigation of Subsurface Structures within Bosso Local Government for Groundwater Exploration Using Magnetic and Resistivity Data	20
Natural Radionuclides assay in Nigerian Granite Rocks	21
VERTICAL ELECTRICAL SOUNDING AND PHYSICO-CHEMICAL ANALYSIS OF GROUND- WATER AND SOIL SAMPLES IN THE VICINITY OF MUNICIPAL SOLID WASTE IN KONTAGORA, NIGER STATE	21
Physics Masterclasses in Africa and the World	21
Doing Digital Offline - The CO-VIDEO Project in South Africa	21
Studies of an injected electron bunch into a superconducting cavity for BriXSinO's ERL	22
Plasma Physics and Fusion Devices and an Introduction to PMI	22
Ubuntu reactors- Modelling Nuclear Reactors with Geant4	22
New hybrid organic-inorganic ferroperovskite nanoparticles for high voltage	23
X-ray technological irradiation for TID studies on silicon sensor and electronic devices in a medical facility	23
Statistical Approach for Detection of Low-Level Radioactivity	23
Assessment of Neutron and Gamma Ray Dose Equivalent Rates in Medical Linear Acceler- ators Operating at Energies Above 10 MV	24
A semi empirical formula for dose calculation in brachytherapy treatment and evaluation of tissue composition effect on dose distribution	24
Dosimetric evaluation of Xio Elekta algorithm using an heterogeneous lung phantom	24
GEANT4 and SRIM evaluation of water equivalent ratio of some dosimetry materials in Carbon therapy beam	24
Development of Supervised and Unsupervised Machine Learning Algorithms for Diagnosis of Malaria Parasites in Thin Blood Smears Using Orange Software	25
Dark-fluid constraints of shear-free universes	25
Thermodynamics of a rotating and non-linear magnetic-charged black hole in the quintessence field	25
Uncovering the fractional order phase transitions in AdS black holes	26
Cosmic hierarchy in $f(R)$ gravity	26
Status and perspectives of the Euclid mission	26
Introduction to Machine Learning and Artificial Intelligence	26

Expanding Universe in the frame of Deformed Phase Space	27
Natural radionuclides and radiological risk assessment of granite mining field in Ariskop, Windhoek, Namibia	27
Solar cells and IoT	27
Structural, optical, electrical and dielectric study of Mg doped ZnO nanocrystals	27
Theoretical study of two biquadratically coupled order parameters: Application to two- dimensional multiferroics	28
Synthesis and study on structural, magnetic and ferroelectric properties of bismuth ferrite nanomaterials	28
Evaluation of radioactivity and radiological health implications of shore sediments along the Okavango riverbank, Namibia	28
Impact de la force tensorielle sur les propriétés fondamentales des isotopes de l'étain Sn	28
Granulometric Discrimination of Marine Sediments	28
Biosensor based on photonic crystal for Checking whether the cell is cancerous or benign	29
Dynamics of Levitating Polaron on the thickness of the liquid helium films sandwich by two substrates under electromagnetic fields	29
New charged Higgs boson discovery channel at the LHC	29
A High Granularity Timing Detector for the ATLAS detector Phase-II upgrade	29
One-loop radiative corrections to double Higgs production in the Inert Higgs Doublet Model in the Electron-Positron colliders	29
Development of Ni-doped SnO ₂ Dilute Magnetic Oxides for electronic and spintronics ap- plications	30
Theoretical investigation of the molecular structure, vibrational spectra, thermodynamic and nonlinear optical properties of 4, 5-dibromo-2, 7dinitro- fluorescein	30
A green synthesis of zinc oxide nanoparticles for water treatment: absorbent for removal of copper from wastewater	30
Vacuum stability of the scalar potential in the compact 341 model	30
Gluon in radiative charmonium decay	30
Investigation of the influence of different terms of the density of states on the color-singlet QGP partition function and some related physical quantities	31
Effects of color-neutrality on the density driven and thermally driven deconfinement phase transition in a finite volume	31
Some characteristics of the deconfinement phase transition in a finite volume: Finite-mass effects on some response functions	31

Calculation of Radiative Corrections of the Tadpole for the Scalar field for the Gauge Field Propagator of Noncommutative Gauge Supersymmetric Theory	31
Physics Education Discussion	31
Laser-assisted processes in standard model and beyond	31
Effet du champ laser sur les rapports de branchement du pion chargé négativement	32
Elastic scattering of a muon neutrino by an electron assisted by laser	32
Muon pair production at e^+e^- colliders in the presence of a circularly polarized laser field	32
Laser-assisted Z-boson decay	32
Magnetic Resonance Brain Image Classification	32
Natural Radioactivity and Associated Radiological Health Hazards Assessment in soil collected around the Van Eck Coal-Fired thermal power plant, Namibia	33
SPIRAL2 (SP2)	33
Laser-assisted high-energy processes	33
Effect of annealing time on the properties of $\text{Cu}_2\text{Fe}_{1-x}\text{Co}_x\text{SnS}_4$ (75% Co) thin film	33
QUANTUMDISTANT CONTROL: QUANTUMGATES TELEPORTATION	34
Announcement of 3 best poster presentations	34
Announcement of 3 best oral presentations	34
Certificates of participation	34
Physics Education status and plan	34
Community Engagement status and plan	35
Young Physicists Forum status and plan	35
Women in Physics Forum status and plan	35
Condensed Matter & Materials Physics	35
Biophysics	35
Earth Science	35
Atomic & Molecular	36
Energies	36
Light Sources	36
Physics for Sustainable Development in Africa	36

General / 34

Welcome address — Cadi Ayyad University in Marrakesh

Abstract Category:

General / 35

Welcome address — Mohammed V University in Rabat

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Abstract Category:

General / 36

Science bridging Cultures and Nations

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International, global scientific research addresses not only key questions in science but also provides successful modes for peaceful cooperation. Global research projects show what mankind is able to achieve when working together coherently towards a common goal. Science and the free dissemination of scientific knowledge facilitate the dialogue among cultures and are instrumental in fostering peaceful relations between nations. The talk will address the role of research infrastructures in science diplomacy through specific examples, in particular CERN and SESAME (Synchrotron-Light for Experimental Science and Applications in the Middle East). What can we learn from such global science endeavours in areas beyond research? What can be achieved, what should be achieved? The talk will address such questions and will describe the fascinating mixture of science and diplomacy.

Abstract Category:

General / 37

Introduction to the African Strategy for Fundamental and Applied Physics (ASFAP)

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The ability to generate scientific innovation and technological knowledge and translate them into new products that are of value to society are key instruments for a society's economic growth and development. As remarkable as these abilities are for other regions in the world, Africa's science, innovation, education, and research infrastructure, particularly in Fundamental and Applied Physics, have over the years been under-valued and under-resourced. Africa cannot afford to lag behind other regions in the world. For that would stretch the technological gap with developed countries even farther. The African Strategy for Fundamental and Applied Physics (ASFAP) initiative was founded with big ambition for change. The aspiration is to demonstrate the potential benefits of physics for African society and to have African countries participate in a global village of technology that is

in the interest of every nation in Africa. ASFAP aims to produce a long-term strategy for reforming and transforming the basic physics research and application, higher education, and scientific research systems in Africa to energize and unlock the minds for brighter economic prospects. Key considerations in ASFAP are a strong desire for investment in African science for economic growth driven by physics-based technologies and its beneficial impact, including other sciences that draw heavily on advances in physics. ASFAP is critical if Africa has to take its place as a co-leader in the global scientific process and reap the consequent socio-economic benefits. ASFAP process will last a few years and eventually produce a final report to inform the African and broader communities about the strategic directions likely to have positive impacts on physics education and research in the next decade. ASFAP should help African policymakers, educators, researchers, communities, and international partners in national, regional, and Pan-African organizations on implementing the defined strategic directions and prioritize educational and research resources and activities. ASFAP will complement African top-down strategies and encourage a broad community participation. The process will be repeated every 7-10 years.

Abstract Category:

Physics Plenary (1) / 38

Status and Impact of Particle Accelerators in Africa

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This talk will explore the status of the particle accelerator laboratories in the African continent. Firstly; the presentation will focus on the different particle accelerator laboratories available on the continent, the type of machines available in each of the facilities. Furthermore, the talk will focus on different research platforms available in each facility on the continent; and the societal impact of these facilities.

Abstract Category:

Physics Plenary (1) / 39

An Astrophysics Journey from the Kalahari to the Edge of the Universe

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I will describe my journey in a broader context of Africa's journey in astrophysics, highlighting some key points along the way. The presentation will aim to celebrate and show selected astrophysics achievements and opportunities in Africa and beyond.

Abstract Category:

Physics Plenary (1) / 40

An Assessment of Atomic and Molecular Physics in Africa

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The Atomic and Molecular field is a bedrock for modern science and emerging technologies owing to its connections to many disciplines of physical and biological sciences as well as important for future economic development. Specifically, the fundamental role that Atomic and Molecular physics (together with Optical physics) is playing in the ongoing revolution in the field of quantum information science and technology cannot be overemphasized. In this talk, I will discuss the current state and identifies the challenges, as well as the promising future presented by the Atomic, Molecular and Optical physics field in Africa.

Abstract Category:

Engagement Plenary / 41

Road to SDG5: Role of Women in Astronomy and Physics for African Growth

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Education and its contribution to science, technology, and innovation are the key points for combating poverty in the long term. Education is also a key point for empowering girls and women, which is fundamental for achieving the United Nations Sustainable Development Goals (SDGs). Astronomy is a powerful tool to promote education and science but, in addition to that, it is also one of the leading sciences for bringing strong technological developments and innovation. The status of astronomy and space science in Africa changed significantly over the past years, becoming emerging fields across the continent, and never before it was more possible to use astronomy for development as it is nowadays. This talk will summarise different activities carried out for empowering girls and women through astronomy in Ethiopia and across the continent, including the creation of the African Network of Women in Astronomy, and show how through them we can combat poverty in the long term, and increase in future our possibilities of attaining the United Nations SDGs, including SDG5, for the benefit of our all society. The last part of the talk will cover a list of recommendations for improving the strong gender gap that we still have in science across the world.

Abstract Category:

Engagement Plenary / 42

Status of Young Physicists Forum and the Importance for Education and Capacity Development for Africa

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The Young Physicists Forum (YPF) was formed in 2021 as one of the engagement groups in the African School of Fundamental and Applied Physics (ASFAP) strategy. The forum was instituted to engage rising-star researchers, and is devoted to developing research and science for the benefit of the public. The main objectives of the forum are among others, to create a diverse continent of next-generation scientific leaders committed to playing an active role in collaborations pertaining to scientific research and educational issues in Africa. Furthermore, the Young Physicists Forum aims at developing the knowledge and skills of young African physicists, grooming them to acquire a fuller understanding of industrial, regional as well as global agendas. In addition, the forum focuses on communicating cutting-edge scientific research and positioning education on the continent within the context of science. Since its inception last year, the forum has played an active role in

identifying the challenges and remedies for young scientists to flourish in various physics fields. To this effect, the forum has so far conducted several virtual meetings to share the knowledge. In the just ended January workshop, for example, the forum invited stakeholders to discuss some of the challenges and opportunities for young African physicists. Notable speakers included Dr. Marie Chantal (University of Rwanda) and Dr. Julia Gonski (Columbia University, United States). The panel discussion included experienced panelists who included Dr. Kétévi Assamagan (Brookhaven National Laboratory), Dr. Lawalley Cole (CAFOR), and Dr. Raissa Malu (IIP). To engage the community, the forum has also conducted a survey on various issues affecting young physicists on the continent. This talk, thus, focuses on the status of the Young Physicists Forum and the importance for education and capacity development for Africa. To join this forum, please start here, <https://twiki.cern.ch/twiki/bin/view/AfricanStrategy/AfYoungPhysicists>.

Abstract Category:

Engagement Plenary / 43

On making physics relevant to society in general and to scientists in particular: Closing the epistemic gap

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Physics has a bad press: it is seen as a boring discipline ever since High School days. There is no glamour to it, just toil and pain, and for many who engaged in it, the end sight is unemployment. Could it be that physicists don't know how to communicate what their field entails to? I will be tackling the problematics of making physics relevant to society and the scientists in general. I will also be dealing with the methodological and educational aspects of teaching and practicing physics, and the need to close the epistemic gap between physics teaching and the physicist understanding ... By the way, do physicists understand physics?

Abstract Category:

Physics Plenary (2) / 44

The African Biophysics Landscape

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In the past couple of decades, biophysics not only contributed to great advances in solving important and fundamental questions in biology, but it has also shown to be a notable source of innovation. In fact, biophysics is a fundamental enabling science in medicine, agribusiness, industrial biotechnology and even sustainable energy. Despite the important role it must play in the development of every country's bioeconomy, Africa remains woefully under-invested in biophysics. This presentation will discuss the current status and impact of biophysics in Africa in terms of education and research capacity development.

Abstract Category:

Physics Plenary (2) / 45

An introduction to quantum computing and quantum information

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Since its discovery, Quantum Mechanics has been used to describe the behaviour of matter in the bulk, e.g. aggregates of atoms in the form of solids, liquids and gases. Technological advances in the past decades have now provided the possibility of manipulating single atoms, ions and photons. This will bring us to a new era which will most likely be dominated by quantum technologies. In this talk we will briefly review these developments and present a few open problems which can be simply formulated.

Abstract Category:

Physics Plenary (2) / 46

Physics of the Earth

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I will talk about frontier research in physics of the solid-Earth in Africa with emphasis on physics of natural hazards such as earthquakes and volcanic eruptions. I will also cover important milestones in the development of the ICTP partnership and community in this specific field in which fundamental physics has direct implications on the society and its resilience.

Abstract Category:

Physics Plenary (3) / 47

Physics education for capacity development and research in Africa

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The acceleration of socio-economic development is intrinsically linked to the level of scientific development. While the existing scientific interventions within Africa played a transformative role in the enhancement of human capital development, adequate investment in research and development is required to make further significant strides going forward. Unlocking Africa's potential requires sustained investment in research and development. However, inadequate expenditure in research and development as a percentage of gross domestic product by African countries does not augur well for the progressive realisation of sustainable scientific development. This presentation highlights challenges afflicting physics education in Africa and provides a reflection on key areas for intervention to strengthen capacity building. Critical interrogation of enablers and constraints is required in order to harness the efficacy of capacity building efforts to engender fundamental transformative change in relation to meaningful enhancement of human capital development. Reconfiguration of the existing scientific interventions some of which yielded remarkable results remains a key strategic imperative in the long to medium term. The realisation of this key strategic imperative hinges to a large degree on the establishment of collaborative partnerships involving key stakeholders. Contextually appropriate recommendations for coherent acceleration of scientific development within the broader African context are advanced.

Abstract Category:

Physics Plenary (3) / 48**African Energy Access and Development: Situation and Research State of the Art**

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Africa is facing a major challenge today, which is access to 100 % energy for the entire continent within ten years. This is a real challenge for researchers and actors working in the field of energy and renewable energy in particular. Indeed, the challenge is less the continent's universal access to energy but rather universal and sustainable access to protect and conserve natural resources and the least possible negative impact of the exploitation of the continent's resources. This, calls on, both politicians and stake-holders to find a balance between the right of access to energy and the socio-economic development of the continent and the sustainable and renewable exploitation of Africa's energy resources. Thus scientists, in particular physicist researchers working in the field of Energy, have an important role in decision-making through scientific and technical advice to be given to politicians and decision-makers.

In this communication, African's energy context will be presented followed by the scientific contribution of African researchers in the field of energy. A presentation of possible orientations for a sustainable and innovative exploitation of energy resources in Africa will be made.

Finally, we will present a review of some examples of results and innovations in the field of. energy in the continent.

Abstract Category:

Physics Plenary (3) / 49**Status and Impact of Fluids and Plasma Physics for Education and Capacity Development in Africa**

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Oluwole Daniel Makinde

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Education and capacity development in the fields of fluid and plasma physics are extremely vital to technological advancement of any nation in generally and Africa in particular. Study of fluid and plasma enable prediction of space weather, medical treatments, and even water purification. Research in fluid and plasma physics are critical to the design of systems in nearly every field of engineering, including aeronautical, astronautical, mechanical, chemical, and civil engineering. In this talk, the three fundamental principles (mass conservation, Newton's second law and energy conservation) governing theoretical research in the field of fluid and plasma physics are discussed. The importance of research capacity development in the field fluid and plasma physics in Africa is emphasized.

Keywords: Importance of fluid and plasma physics; Conservation laws; Maxwell laws of electromagnetism; Africa research capacity development

Abstract Category:

Physics Plenary (4) / 50

Light sources for capacity building and research in Africa

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Light sources proved to be super-efficient in a wide range of applications such as physics, chemistry, biology, geology, biomedicine, agriculture, environment, materials science, cultural heritage and archeology. Therefore, their scientific and societal impact on education, science and technology development, besides capacity building, cannot be doubted. During the last two decades, a huge demand in the implementation of light sources all over the world is witnessed. This talk will highlight the light sources significance for Africa. A highlight on the ASFAP Light Sources working group will be also presented. The working group aims at advising on strategies towards light sources in Africa, with considerations of compact light sources, synchrotron light sources, and other related topics relevant to an African context such as the capacity building development.

Abstract Category:

Physics Plenary (4) / 51

Condensed Matter and Materials Physics Capacity building and Research for African Development

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Africa has abundant materials that have not been fully utilized to make a significant impact on the development of the continent. Given that Condensed Matter and Materials Physics deals with properties of matter at ordinary chemical and thermal energy scales, it has the largest number of direct practical applications. Condensed Matter and Materials Physics has played a key role in the technological advances that have changed our lives so dramatically in the last 50 years as evidenced by many associated discoveries ranging from the integrated circuit, magnetic recording disks to high performance composite materials. Consequently, Condensed matter and Materials Physics is seen as the key to unlocking the potential that the abundant materials in Africa have for continental development.

The presentation will give an overview of the status of education, capacity building and research in Condensed Matter and Materials Physics on the African continent. It will also show initiatives in place and proposed way forward to improve the status.

Abstract Category:

ASP Forum / 52

Welcome address

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Abstract Category:

ASP Forum / 53

The African School of Fundamental Physics and Applications (ASP)

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The African School of Fundamental Physics and Applications (ASP) is a biennial school in Africa. It is based on the observation that fundamental physics provides excellent motivation for students of science. The aim of the school is to build capacity to harvest, interpret, and exploit the results of current and future physics experiments and to increase proficiency in related applications. The participating students are selected from all over Africa. The school also offers a workshop to train high school teachers, an outreach to motivate high school pupils and a physics conference to support a broader participation of African research faculties. ASP was started in 2010, but has since evolved to be much more than a school—it has grown to become a program of continuous activities with directed ethos towards physics as an engine for development in Africa. In this talk, we will present the school and discuss strategies to make it sustainable.

Abstract Category:

ASP Forum / 54

ASP2022 — South Africa

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By September 30, 2019, South Africa was among four African countries that have submitted proposals to the International Organizing Committee (IOC) of the African School of Fundamental Physics and Applications (ASP) to host ASP2022. After reviewing all the proposals, the IOC in December of 2019 unanimously selected the bid from South Africa with the main aim of boosting capacity in smaller universities and in rural regions. The venue for ASP2022 in South Africa will be the Nelson Mandela University in Gqeberha (formerly Port Elizabeth) in the Eastern Cape Province.

This presentation will highlight the journey since the announcement, the host, supporting activities, and the current status regarding ASP2022 logistics & preparations.

Abstract Category:

ASP Forum / 55

ASP Discussion

Abstract Category:

ASP Forum / 56

Vote of Thanks

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Abstract Category:

ASP Forum / 57

STEM Capacity Building Strategies for African Development

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Abstract Category:

ASP Forum / 58

Physics Research Strategies for African Development

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Abstract Category:

ASP Forum / 59

Panel Discussion – Theme: Physics education and research roadmap development and implementation in Africa

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Panelists:

1. Dr. Raissa Malu Directrice - Investing In People (IIP) ASBL Member of the Democratic Republic of Congo Presidential Panel to the African Union
2. Prof. Oumar Ka Université Cheikh Anta Diop de Dakar, Sénégal Founding member and current President of the Senegalese Physical Society Co-Vice President of the West African Physical Society
3. Dr. Melissa Denecke Director | Division of Physical and Chemical Sciences Department of Nuclear Applications, International Atomic Energy Agency
4. Prof. Catherine Jane Ngila The Acting Executive Director of the African Academy of Sciences (AAS)

Abstract Category:

Physics Plenary (5) / 60

Nuclear Physics in Africa – Education, Research and Challenges

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African development depends on its array of technological advancement and human-capital resources. Nuclear physics has proven to be part of the essential area that has contributed to the

ongoing industrialization from the inception of Manhattan project. Meanwhile, African countries are still in the crawling stage despite the abundance of intellectual capacities and abundance resources. The focus of this talk will be on the available nuclear physics research facilities in Africa, as compiled by the IAEA physics section, and their various research applications ranging from basic and fundamental research, analytical services, medical, as well as environmental radiation. The role of African government policies towards the advancement of science and technology will also be mentioned.

Abstract Category:

Physics Plenary (5) / 61

On Particle Physics, ASFAP and Education in Africa: Status and Challenges

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In this this talk, I will give an overview of the particle physics community in Africa with a focus on some research groups actively involved in the LHC experiments.

It will also highlight the recent activities of the working group dedicated to this particle physics through ASFAP strategy whose aim is to provide a shared roadmap for the field. Finally, I will briefly discuss the impact of particle physics on education in the continent.

Abstract Category:

Particle Physics

Physics Plenary (7) / 62

Solar Powered Radiotherapy in Africa

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Title: Solar-powered Radiotherapy 4.0 – chance for Radio-Oncology in Africa

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Introduction:

WHO estimate that 14 million people around the world are diagnosed with cancer each year and half of them live in developing countries. Around 70% of the people who die from cancer live now in low-income or medium-income countries. Cancer kills more people than HIV/AIDS, tuberculosis and malaria together. All these people share only 3% of the world's health care professionals and 1% of the world's total costs for health care. 50-60% of cancer patients require radiotherapy as important (and cost effective) part of their treatment. There is an estimated shortage of around 5.000 radiotherapy machines in low-middle-income-countries (LMICS). The majority of people in Africa suffering from cancer has no or limited access to radiotherapy technology. State of the art radiotherapy machines (linear-accelerators) need (uninterruptable) electrical power.

Project-plan, Implementation in Singen (Germany):

The Lake Constance Radiation Oncology Center, Singen run 2 Linacs of ELEKTA and 1 go.SIM-CT-Scanner of SIEMENS. The power consumption is about 150-170 MWh/a. The annual cost was about

35.000€ (dropped to 24.000€). Investigation on kW-peak-behavior of the ELEKTA-Linacs, CT, IT and cooling and a site-dependence computer-simulation on solarization was done to determine the solar-field. A cost-plan (return of investment) was developed. Each year the solar-harvest is about 55-60 MWh (based on 400m²-solar-field on the roof). It can be shown, that the annual cost can be cut by 30-40%; in summer the site is completely independent from public-grid. In case of low-sun periods electrical-power is purchased from public grid. In sunny periods the solar-generator feeds back energy in the neighborhood-hospital!

Project-cost-plan, Implementation in Ghana:

2016 the OiER (Organization for International Economic Relations, Vienna) and ELEKTA asked for a consultancy of planning a solar-power solution of the "Sweden Ghana Medical Centre". This site runs one ELEKTA-Linac, CT and MR. The annual consumption is about 270 MWh. Energy-cost from the grid is about 100.000€ in this region. A computerized simulation on solarization for this site was done. An installation schema was developed. An autarkic energy solution (solar panels + battery container) was preferred. Total cost of implementation was about 300.000€ (2017). Due to the unknown roof-shielding and the expected damage of the panels by radiation the concept of roof-mounting was converted into an area-mounting beside the main buildings minimizing cabling.

Perspective on Education, Training, Controlling:

It makes sense to expand treatment-capacity of existing sites. Increasing staff-number and staff-experiences is obligatory. Electrical power stability and autarkic, technical solutions must be included in purchasing-plans of radiotherapy-machines. Communication (Internet, Mobile, video-conferencing) need power as well. Help for low-experienced staff-group can be obtained from using automatic-planning of patients-therapy, checking and controlling with digital-assistance systems (online-dosimetry, portal-dosimetry, process-control and risk-control). All of those systems can be audited and supported via internet) as to be shown in our departments (Project: RADIOTHERAPY 4.0). Cyber-education on site by experienced remote-trainers can be ordered.

Abstract Category:

Physics Plenary (6) / 63

Laser Research in Africa

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Laser research remains a highly topical field, despite being more than half a century old. The history of laser research in Africa is nearly as long as the history of the laser itself, with research spanning the North and the South, from physics to biology. Lasers are now ubiquitous tools in most university laboratories, where world class research is done in a variety of fields. In this talk I will give a brief historical review of laser research in Africa, with a particular focus on South Africa, highlighting in particular the scientific achievements made over the past decade.

Abstract Category:

ASFAP Working Group Summaries / 65

ASFAP Working Group Summary of Societal Engagements

Corresponding Author: mounia.laassiri@gmail.com

This talk presents the summary of the ASFAP working meeting on Monday, March 7, at 16:30 about

societal engagements, <https://indico.cern.ch/event/1060503/timetable/?view=standard#day-2022-03-07>.

Abstract Category:

ASFAP Working Group Summaries / 66

ASFAP Working Group Summary of Light Sources & Applications

Corresponding Author: sonia.haddad@fst.utm.tn

This talk presents the summary of the ASFAP working meeting on Tuesday, March 8, at 16:30 about light sources and their applications, <https://indico.cern.ch/event/1060503/timetable/?view=standard#day-2022-03-08>.

Abstract Category:

ASFAP Working Group Summaries / 67

ASFAP Working Group Summary of Particle, (Astro)particle physics & Applications

Corresponding Author: maria.moreno.llacer@cern.ch

This talk presents the summary of the ASFAP working meeting on Thursday, March 10, at 16:00 about particles and related fields, <https://indico.cern.ch/event/1060503/timetable/?view=standard#day-2022-03-10>.

Abstract Category:

ASP, ASFAP / 68

ASP COVID-19 Data Analysis Results

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We studied the COVID-19 pandemic evolution in ten African Countries, namely Benin, Cameroon, Ghana, Kenya, Madagascar, Mozambique, Rwanda, South Africa, Togo, and Zambia. For each country considered, we modeled simultaneously the data of the active, recovered and death cases. In this study, we used a year of data since the first cases were reported. We estimated the time-dependent basic reproduction numbers, R_0 , and the fractions of infected but unaffected populations, to offer insights into containment and vaccine strategies in African countries. We found that $R_0 \leq 4$ at the start of the pandemic but has since fallen to $R_0 \sim 1$. The unaffected fractions of the populations studied vary between 1–10% of the recovered cases. The results are published in the Scientific African, <https://doi.org/10.1016/j.sciaf.2021.e00987>. We are continuing the study by including impacts of vaccination campaigns, and new countries such as Nigeria. In this talk, I will present the study and the results.

Abstract Category:

ASP, ASFAP / 69

IEEE Nuclear and Plasma Science Society**Corresponding Author:** stefan.ritt@psi.ch

IEEE is the world's largest professional association with more than 400'000 engineers and physicists worldwide. It contains 46 societies, with the Nuclear and Plasma Sciences Society (NPSS) being one of them, with about 3'000 members. Since several years NPSS organizes instrumentation schools in the areas of instrumentation for particle physics and medical imaging (PET). The schools were mainly held in developing countries like Vietnam, South Africa, Malaysia and Senegal, and were a mixture of introductory lectures and practical hands-on sessions in electronics, data acquisition and analysis. Efforts are currently under way to join efforts and resources between ASP and NPSS for future schools.

Abstract Category:

ASP, ASFAP / 70

ASFAP path forward & Feedback from IAC**Corresponding Author:** f.quevedo@damtp.cam.ac.uk**Abstract Category:**

International Institutes / 71

APS Forum on International Physics (FIP)**Corresponding Author:** christine.darve@cern.ch

The Forum on International Physics (FIP) is a voluntary association of the American Physical Society (APS) members, who are interested in advancing the knowledge of physics and its diffusion by fostering cooperation and communication among physicists of all countries. The FIP organizes focused sessions at APS meetings and the PHYSICS MATTERS monthly colloquia series as a "Physics for Development" initiative in COVID times. The FIP also distributes nominations for Distinguished Students travel grants, APS fellowships, and a Wheatley Award.

The unique strength of the FIP lies in the openness of its agenda, which reflects the grassroots origin of this Forum.

This talk will describe the FIP program and will present possible synergies with the program of the African School of Fundamental Physics and Applications.

Abstract Category:

International Institutes / 72

Feedback from UNESCO

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Abstract Category:

ASFAP Working Groups / 87

Discussion on Societal Engagements: Community Engagement, Young Physicists, Women in Physics and Physics Education

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Abstract Category:

ASFAP Working Groups / 88

Joint Session on Light Sources and Applications: Light Sources, Accelerators, biophysics, Earth Science, Atomic & Molecular, Condensed Matter & Materials Physics, Optics & Photonics, Energies, Instrumentation, and Computing

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Abstract Category:

ASFAP Working Groups / 90

Particles and Applications: Accelerators, Particle Physics, Nuclear Physics, Medical Physics, (particle)Astrophysics & Cosmology, Fluid & Plasma, Complex Systems, Instrumentation & Detectors, Computing, and Nuclear Energy

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Parallel Session 1 / 132

Determination of the thickness and optical properties by reflectance method

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Abstract Category:

Parallel Session 1 / 133

Structural, electronic and optical properties of CN, C₂N₂ and C₄N₂ nanotubes resulting from N-doping small (3,3) SWCNT : A DFT study

Abstract Category:

Parallel Session 1 / 134

Electron-phonon and Spin orbit coupling in transition metal dichalcogenides quantum dot after short pulse excitation under magnetic field

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Abstract Category:

Parallel Session 1 / 135

Density functional study of conductive organic polymers derived from PPE-PPV

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Abstract Category:

Parallel Session 1 / 136

Effect of chemical composition on the structure and dielectric properties of pure and doped Al₂O₃-ZrO₂ composites

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Parallel Session 1 / 137

Gamma-ray mass attenuation coefficient of environmentally friendly $\text{Bi}_{0.5}\text{Na}_{0.34}\text{K}_{0.11}\text{Li}_{0.05}\text{Ti}_{1-x}\text{Ni}_x\text{O}_3$ ceramics

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Abstract Category:

Parallel Session 2 / 138

A High-Granularity Timing Detector (HGTD) in ATLAS Phase-II Upgrade: Physics and performance with HGTD

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Parallel Session 2 / 139

Minimum bias simulation of parasitic collisions

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Parallel Session 2 / 141

Search of new resonances decaying into top quark pairs in the lepton+jet final state in proton-proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

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Abstract Category:

Parallel Session 2 / 142

Search for charged Higgs boson via $H^\pm W^\mp$ at the LHC

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Abstract Category:

Parallel Session 2 / 143

Search for invisible Higgs bosons produced via vector boson fusion (VBF) at the LHC using the ATLAS detector

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Poster Session in Gather.Town / 144

Structural and Optical proprieties of CuxS deposited by flash evaporation

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Abstract Category:

Parallel Session 1 / 145

Structural analysis and band gap engineering of 2D perovskite Cs₂XAg(I_{1-x}Br_x)₆ for solar cell applications using DFT method

Parallel Session 1 / 146

Properties of the structure, electronics and opticals of AB andAA stacking bilayer graphene intercalated by Sr atom

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Parallel Session 1 / 147

Structural, Electronic and Optical parameters of Zn₂VN₃ Compounds by Density functional theory

Parallel Session 1 / 148

Preparation and characterization CNCTS thin films for solar cells without a sulfurization step

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Abstract Category:

Parallel Session 1 / 149

Structural, elastic, thermodynamic, electronic, optical and thermoelectric properties of lead-free double perovskites Cs₂NaBiX₆ (X= Cl, Br, I) from ab-initio calculations

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Abstract Category:

Parallel Session 2 / 150

Extended Higgs sector of 2HDM with real triplet : Theoretical and phenomenological studies at the LHC

Corresponding Author: brahim.aitouzghour@edu.uca.ac.ma

Abstract Category:

Parallel Session 2 / 151

Measurement of azimuthal angular correlations of D mesons with charged particles in pp collisions at $\sqrt{s} = 13$ TeV with ALICE at the LHC

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Abstract Category:

Parallel Session 2 / 152

3-Dimensional BF Theory On Seifert Fibered Manifolds

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Abstract Category:

Parallel Session 2 / 153

Multiplicity dependence of heavy-flavour production in small systems in ALICE

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Abstract Category:

Parallel Session 2 / 154

Light charged Higgs boson decays to a W^\pm and a BSM Higgs boson at the LHC

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Parallel Session 2 / 157

D-meson Suppression and Azimuthal Anisotropy in a Strongly Coupled Plasma at $\sqrt{s_{NN}} = 5.5$ TeV with Comparison to LHC Measurements

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Abstract Category:

Parallel Session 2 / 158

On the DDM and ML quantum concepts in nuclear shape phase transitions of atomic nuclei

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Parallel Session 2 / 159

Using Microphotonic Nuclear Forensics to Mediate Nuclear Security and Nuclear Safety

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Abstract Category:

Parallel Session 2 / 160

Soil gas radon, indoor radon and its diurnal variation in Northern region of Cameroon

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Abstract Category:

Parallel Session 3 / 161

Evaluation of whole body dose absorbed by Geant4 simulation

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Abstract Category:

Parallel Session 3 / 162

Monte Carlo Simulation of the Biograph mCT PET scanner using GATE

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International Institutes / 163

The African Light Source

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The world faces many challenges, articulated in the UN Sustainable Development Goals. African faces these challenges too and has in addition its own versions of them, as well as others. Consider also that we also need not only applied research to address these challenges, but also curiosity driven fundamental research. This advances knowledge and has longer timescales. It prepares humanity to address problems in new ways, and to address problems that have not yet manifested to the same extent as the previous ones. Having identified then the research issues, we can ask what science will contribute, and from there, what instrumentation. The single most significant instrument that emerges, is the modern light source, which is then surely a most transformative mega-research. Research is both fundamental and applied. Both streams lead to innovation, competitive industry, the solution of problems of particular relevance for Africa, high end human capacity development, building the culture of learning, the inspiration of young learners to greater efforts and building a new generation of competent and enabled youth. There are other aspects, such as science diplomacy, pan Africanism, the globalisation and democratisation of participation in new knowledge generation, the implication that the large scale research infrastructure is fed by a healthy regional and national capacity in terms of human and equipment infrastructure. The passionate belief in this positive role for mega-science in society has driven the momentum towards the African Light Source. A combination of African and International leadership towards an African Light Source is embodied in the project for a Light Source in Africa. These COVID times have seen the Light Source designated as an essential service, remaining open during lockdown, as the front-runner in the fight against this greatest scourge of our decade. Indeed, we would like to see Africa extend its already significant contribution, to combating this disease, and especially others of particular relevance to Africa, as well as those of the next Pandemics. This contribution details the progress on the Roadmap towards the African Light Source, and outlines especially the current and future projects.

Abstract Category:

Parallel Session 2 / 164

Investigation of Subsurface Structures within Bosso Local Government for Groundwater Exploration Using Magnetic and Re-

sistivity Data

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Abstract Category:

Parallel Session 2 / 165

Natural Radionuclides assay in Nigerian Granite Rocks

Corresponding Author: olarinoyeleke@gmail.com

Abstract Category:

Parallel Session 2 / 166

VERTICAL ELECTRICAL SOUNDING AND PHYSICO-CHEMICAL ANALYSIS OF GROUNDWATER AND SOIL SAMPLES IN THE VICINITY OF MUNICIPAL SOLID WASTE IN KONTAGORA, NIGER STATE

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Abstract Category:

Parallel Session 3 / 167

Physics Masterclasses in Africa and the World

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Uta Bilow, Technische Universität Dresden, Germany

Kenneth Cecire, University of Notre Dame, USA

International Masterclasses (IMC) enable high school students and teachers to work with particle physicists to analyze authentic data from contemporary experiments and experience being “physicists for a day”. The IMC program has a worldwide reach, including several universities and research institutes in Egypt, Algeria, Morocco, Cape Verde, and South Africa. As technical infrastructure in Africa improves, there is a great opportunity for many more African institutes to offer IMC on their premises. The authors will discuss the advantages of IMC to Africa, how institutes may join, and ways to overcome obstacles.

Abstract Category:

Parallel Session 3 / 168

Doing Digital Offline - The CO-VIDEO Project in South Africa

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Unizulu Science Centre (USC) in Richards Bay, South Africa, has been running face to face matric workshops for 25 years, presenting practicals and sharpening skills for over 200 000 matric science students. The 2020 lockdown presented a dilemma: matrics needed assistance more than ever, but schools were closed and large gatherings impossible. Many SC's around the world went online, making digital content available through the internet. Very few of the schools in which USC works have reliable internet and almost none of the homes, so this route was not possible. USC worked to convert a 4 hour contact workshop into 8 one-hour videos, highlighting the essential skills for Matric Science Paper 1 – the physics paper. While these videos were made available on the internet for download or streaming, they were physically distributed on memory sticks to teachers, along with an accompanying 48-page workbook. Local industry funding saw provision for the local school district (5500 students in 180 schools) and further South African Institute of Physics funding (with support from Allan Gray) saw a further 20 000 booklets printed and 500 memory sticks manufactured. These were distributed to schools in 3 other provinces and used as the basis for teacher training.

In 2021, the Physics booklet and videos were extensively rewritten and refilmed, adding about 50 % more content and updating with 2020 exams. In addition, projects are underway to make a video series for Life Science and Chemistry. The International Year of Basic Science for Sustainable Development in 2022 makes this project extremely relevant once again in the 2022 school year. Valuable lessons learnt in the process will be shared.

Abstract Category:

Parallel Session 3 / 170

Studies of an injected electron bunch into a superconducting cavity for BriXSinO's ERL

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Abstract Category:

Parallel Session 3 / 171

Plasma Physics and Fusion Devices and an Introduction to PMI

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Abstract Category:

Parallel Session 3 / 172

Ubuntu reactors– Modelling Nuclear Reactors with Geant4

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Abstract Category:

Parallel Session 3 / 173

New hybrid organic-inorganic ferrophotovoltaic perovskites nanoparticles for high voltage**Corresponding Author:** r.ndiokane1532@zig.univ.sn**Abstract Category:**

Parallel Session 3 / 174

X-ray technological irradiation for TID studies on silicon sensor and electronic devices in a medical facility**Corresponding Author:** benedetto.diruzza@tifpa.infn.it

Total Ionizing Dose (TID) effects tests are required not only for silicon particle sensors developed in high energy physics experiments, but also for electronic devices and elements used in commercial, automotive and space applications. These tests and studies can be performed not only in facilities explicitly built for this mission, but also in medical or biological research facilities when some minima requirements are satisfied. Generally this irradiations can be performed without interfering with the medical and biological tasks of the facility. In this talk will be shown why these studies are extremely relevant for research and industries, how to perform these irradiations and the minimum instrumentation required for this type of studies. Finally will be described the planification and realization of SiPM x-ray irradiations for TID characterization realized in the Italian TIFPA-INFN Trento Center laboratory, using instruments originally realized for medical or biological irradiations.

References

- [1] Di Ruzza, B.; Possibility of Total Ionizing Dose Effects measurements for LHC experiments elements in a medical facility: the TIFPA-INFN experience
doi: 10.22323/1.397.0247; <https://pos.sissa.it/397/247/>
- [2] Di Ruzza, B. et al.; Radiation damage on SiPMs for Space Applications
<https://arxiv.org/abs/2112.08089>

Abstract Category:

Parallel Session 3 / 175

Statistical Approach for Detection of Low-Level Radioactivity**Corresponding Author:** hanan.arahmane@gmail.com

Decommissioning involves activities such as the dismantling of power plants. Amongst the various technical challenges of decommissioning is to carry out accurate radioactivity measurements of a wide area of waste types. In this paper, we aim at measuring a low-activity uranium contamination on concrete surfaces, with varying enrichment encountered levels within a basic nuclear facility. In this context, we have developed an advanced method based on Bayesian inference. It allows to take a reasonable decision when using restricted and possibly conflicting information from various sources.

The implementation of the Bayesian approach is based on a priori vectors constructed from the coupling of experimental data acquired within a basic nuclear facility using high-resolution gamma-ray spectrometry based on a high-purity germanium diode detector (HPGe), as well as simulated data with Monte Carlo N-Particles 6 transport code. The performance evaluation and characterization of Bayesian method were performed using classical receiver operating characteristic curves (ROC) with the study of the radiological background variations effect. The results clearly indicate that the proposed method allows to adjust the confidence degree in the stationarity of the radiological background. They also show that for a stable radiological background, our proposed approach provides a significantly higher tradeoff between specificity and sensitivity, close within 1 to the behavior of an ideal detection procedure with a little degradation in the case of the variability of the background radiation as expected under such constraints. Moreover, Bayesian inference proved their ability to ensure an acceptable tradeoff between the true detection rate (TDR), the false alarm rate (FAR) and the response time, in order to be compatible with the user's requirements.

Abstract Category:

Parallel Session 3 / 176

Assessment of Neutron and Gamma Ray Dose Equivalent Rates in Medical Linear Accelerators Operating at Energies Above 10 MV

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Abstract Category:

Parallel Session 3 / 177

A semi empirical formula for dose calculation in brachytherapy treatment and evaluation of tissue composition effect on dose distribution

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Parallel Session 3 / 178

Dosimetric evaluation of Xio Elekta algorithm using an heterogeneous lung phantom

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Abstract Category:

Parallel Session 3 / 179

GEANT4 and SRIM evaluation of water equivalent ratio of some dosimetry materials in Carbon therapy beam

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Parallel Session 3 / 180

Development of Supervised and Unsupervised Machine Learning Algorithms for Diagnosis of Malaria Parasites in Thin Blood Smears Using Orange Software

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Highly sensitive malaria diagnosis methods that are satisfactory for point-of-care testing in high burden areas are essential for productive treatment of the disease. Microscopists often examine blood smears to diagnose disease and compute parasitemia. Hence, the need for highly trained experts to interpret the data. In this paper, machine learning algorithms for the detection of malaria parasite in thin blood smear images is developed to abolish the reliance on human proficiency. The datasets containing 27558 cell images were obtained from National Library of Medicine, NIH. For supervised learning, logistic regression and random forest classifiers were used for classification, in which logistic regression gave 93.5% accuracy for parasitized and 96.5% for uninfected and random forest gave 90.5% accuracy for parasitized and 90.4% for uninfected. For unsupervised learning, hierarchical clustering clustered parasitized images in one cluster and uninfected in another cluster and k-means discovered two clusters from the dataset. It is concluded that, although this method may not fully abolish the need for trained experts, the algorithms can be of great assistance in aiding the diagnostic decision-making process.

Abstract Category:

Parallel Session 1 / 181

Dark-fluid constraints of shear-free universes

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Recent studies into the nature of dark matter and dark energy have resulted in a number of dark-fluid cosmological models. Integrability conditions arising from general irrotational fluid-flow considerations of a universe dominated by one such dark fluid will be investigated under special assumptions on the nature of the spacetime shear. Special emphasis will be placed on linearized perturbations of quasi-Newtonian and anti-Newtonian spacetimes, whereby the conditions for the existence and consistent evolution of such spacetimes in the presence of the Chaplygin gas fluid model will be derived and discussed.

Abstract Category:

Parallel Session 1 / 182

Thermodynamics of a rotating and non-linear magnetic-charged black hole in the quintessence field

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Abstract Category:

Parallel Session 1 / 183

Uncovering the fractional order phase transitions in AdS black holes

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Abstract Category:

Parallel Session 1 / 184

Cosmic hierarchy in $f(R)$ gravity

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Parallel Session 1 / 185

Status and perspectives of the Euclid mission

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Euclid is the M2 mission of ESA's Cosmic Vision program dedicated to the study of the dark universe: Dark Matter and Dark Energy, with launch scheduled for 2022. Euclid will observe 15,000 square degrees of extragalactic sky in the visible band with resolution of 0.1arcsec (VIS), in IR photometry for the Y, J, H bands and in slitless spectroscopy between 1 and 2 microns (NISP). Euclid will be able to measure the gravitationally induced distortion of the apparent shapes of about one billion of galaxies (Weak Lensing), and Galaxy Clustering (BAO and RSD), using several tens of millions of spectroscopic redshift determinations and billions of photometric redshifts. After a short introduction to the problem of the accelerated expansion of the Universe and Dark Energy the talk will illustrate the scientific objectives of Euclid and give an update of its status, along with the expected results and foreseen precision and accuracy [1,2].

References:

[1] Euclid Collaboration "Euclid preparation: VII. Forecast validation for Euclid cosmological probes" A&A 642, A191 (2020) [arXiv:1910.09273] doi:10.1051/0004-6361/202038071

[2] Euclid Collaboration "Euclid preparation: XV. Forecasting cosmological constraints for the Euclid and CMB joint analysis" A&A 657, A91 (2022) [arXiv:2106.08346] doi:10.1051/0004-6361/202141556

Abstract Category:

Physics Plenary (5) / 186

Introduction to Machine Learning and Artificial Intelligence

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As the amount of data collected from systems in operation increases, the need to effectively analyse this data to gain knowledge about the state of the system increases alike. Leveraging data-driven methods for this analysis allows us to process massive amounts of data more efficiently, as well as gain insights about our systems which we may otherwise have overlooked or not known of their presence altogether.

Machine Learning algorithms by design require large volumes of data to be able to accurately represent systems based on recorded data. This means that for systems which are highly measured, machine learning algorithms can be leveraged for further analysis. In addition, this representation that is learned from the data can be retained and employed for make future inferences without having to touch the data again. This is particularly useful for closed systems, for example, as inferences can be made in real-time allowing for timeous decision-making.

The applications of machine learning methods are far ranging and this talk will give an introductory overview of Machine Learning as well as a list of resources to help those who may be looking to learn how to apply such methods to their own work. It will also go over a very simplified example to show a machine learning model training cycle and some key aspects to think about when reviewing your trained model's metrics.

Abstract Category:

Poster Session in Gather.Town / 187

Expanding Universe in the frame of Deformed Phase Space

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Abstract Category:

Poster Session in Gather.Town / 188

Natural radionuclides and radiological risk assessment of granite mining field in Ariskop, Windhoek, Namibia

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Poster Session in Gather.Town / 189

Solar cells and IoT

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Abstract Category:

Poster Session in Gather.Town / 190

Structural, optical, electrical and dielectric study of Mg doped ZnO nanocrystals

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Abstract Category:

Poster Session in Gather.Town / 191

Theoretical study of two biquadratically coupled order parameters: Application to two-dimensional multiferroics

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Abstract Category:

Poster Session in Gather.Town / 192

Synthesis and study on structural, magnetic and ferroelectric properties of bismuth ferrite nanomaterials

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Poster Session in Gather.Town / 193

Evaluation of radioactivity and radiological health implications of shore sediments along the Okavango riverbank, Namibia

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Abstract Category:

Poster Session in Gather.Town / 194

Impact de la force tensorielle sur les propriétés fondamentales des isotopes de l'étain Sn

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Abstract Category:

Poster Session in Gather.Town / 195

Granulometric Discrimination of Marine Sediments

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Abstract Category:

Parallel Session 1 / 196

Biosensor based on photonic crystal for Checking whether the cell is cancerous or benign

Poster Session in Gather.Town / 197

Dynamics of Levitating Polaron on the thickness of the liquid helium films sandwich by two substrates under electromagnetic fields

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Abstract Category:

Poster Session in Gather.Town / 198

New charged Higgs boson discovery channel at the LHC

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Abstract Category:

Poster Session in Gather.Town / 199

A High Granularity Timing Detector for the ATLAS detector Phase-II upgrade

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Poster Session in Gather.Town / 200

One-loop radiative corrections to double Higgs production in the Inert Higgs Doublet Model in the Electron-Positron colliders

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Abstract Category:

Poster Session in Gather.Town / 201

Development of Ni-doped SnO₂ Dilute Magnetic Oxides for electronic and spintronics applications

Abstract Category:

Poster Session in Gather.Town / 202

Theoretical investigation of the molecular structure, vibrational spectra, thermodynamic and nonlinear optical properties of 4, 5-dibromo-2, 7-dinitro- fluorescein

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Poster Session in Gather.Town / 203

A green synthesis of zinc oxide nanoparticles for water treatment: absorbent for removal of copper from wastewater

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Abstract Category:

Poster Session in Gather.Town / 204

Vacuum stability of the scalar potential in the compact 341 model

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Abstract Category:

Poster Session in Gather.Town / 205

Gluon in radiative charmonium decay

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Abstract Category:

Poster Session in Gather.Town / 206

Investigation of the influence of different terms of the density of states on the color-singlet QGP partition function and some related physical quantities

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Poster Session in Gather.Town / 207

Effects of color-neutrality on the density driven and thermally driven deconfinement phase transition in a finite volume

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Poster Session in Gather.Town / 208

Some characteristics of the deconfinement phase transition in a finite volume: Finite-mass effects on some response functions

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Abstract Category:

Poster Session in Gather.Town / 209

Calculation of Radiative Corrections of the Tadpole for the Scalar field for the Gauge Field Propagator of Noncommutative Gauge Supersymmetric Theory

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Abstract Category:

Parallel Session 3 / 210

Physics Education Discussion

Abstract Category:

Poster Session in Gather.Town / 211

Laser-assisted processes in standard model and beyond

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Abstract Category:

Poster Session in Gather.Town / 212

Effet du champ laser sur les rapports de branchement du pion chargé négativement

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Abstract Category:

Poster Session in Gather.Town / 213

Elastic scattering of a muon neutrino by an electron assisted by laser

Poster Session in Gather.Town / 214

Muon pair production at e^+e^- colliders in the presence of a circularly polarized laser field

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Poster Session in Gather.Town / 215

Laser-assisted Z-boson decay

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Abstract Category:

Parallel Session 3 / 216

Magnetic Resonance Brain Image Classification

Abstract Category:

Poster Session in Gather.Town / 217

Natural Radioactivity and Associated Radiological Health Hazards Assessment in soil collected around the Van Eck Coal-Fired thermal power plant, Namibia

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Poster Session in Gather.Town / 218

SPIRAL2 (SP2)

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Abstract Category:

Nuclear Physics

Parallel Session 2 / 220

Laser-assisted high-energy processes

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In this presentation, I will talk about some laser-assisted. processes in high energy physics. Through this theoretical study, we will show that the physical properties of charged particles change when they are subjected to an intense electromagnetic field.

Abstract Category:

Particle Physics

Poster Session in Gather.Town / 221

Effect of annealing time on the properties of Cu₂Fe_{1-x}Co_xSnS₄ (75% Co) thin film

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Abstract Category:

Poster Session in Gather.Town / 222

QUANTUMDISTANT CONTROL: QUANTUMGATES TELEPORTATION

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Abstract Category:

General / 223

Announcement of 3 best poster presentations

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General / 224

Announcement of 3 best oral presentations

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General / 225

Certificates of participation

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ASFAP Working Groups / 226

Physics Education status and plan

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Abstract Category:

ASFAP Working Groups / 227

Community Engagement status and plan

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Abstract Category:

ASFAP Working Groups / 228

Young Physicists Forum status and plan

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Abstract Category:

ASFAP Working Groups / 229

Women in Physics Forum status and plan

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Abstract Category:

ASFAP Working Groups / 231

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Abstract Category:

ASFAP Working Groups / 232

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Abstract Category:

ASFAP Working Groups / 233

Earth Science

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ASFAP Working Groups / 234

Atomic & Molecular

ASFAP Working Groups / 235

Energies

ASFAP Working Groups / 236

Light Sources

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Colloquium / 237

Physics for Sustainable Development in Africa

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More than 60 years after independence, almost all African countries are still trying to achieve economic development. Several action plans to achieve this goal have been adopted and all of them stressed the need to put science and technology in the service of development by reinforcing the autonomous capacity of our countries in this field. From the Monrovia Strategy in 1979, the Lagos Plan of Action (LPA) for the economic development of Africa [1980-2000] to the Consolidated Plan of Action (CPA) which consists of three inter linked pillars: capacity building, knowledge production and technological innovation, African countries are trying to advance education, science and technology, and human capital development in the continent. The current AU Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) places STI at the epicentre of Africa's social and economic development within the long-term AU Agenda 2063. Through the implementation of STISA-2024, science, technology, and innovation are expected to impact critical sectors including agriculture, energy, environment, health, infrastructure, mining, security, and water, among others. This strategy is designed to respond to the need of transforming Africa into a Knowledge-based and Innovation-led Society. The fact is that Africa is changing, economic, social and infrastructural progress is visible, but at what pace and under what conditions, which raises questions about the strategic choices facing African decision-makers in a world where the knowledge economy dominates. In this presentation, we try to give some thoughts on the role that Physics could play in the achievement of Africa's sustainable development goals. The focus will be on the potential contribution of Physics to achieving the objectives of the Agenda 2063 flagship projects.