The Abdus Salam International Centre for Theoretical Physics
Physics Without Frontiers

United Nations Educational, Scientific and Cultural Organization

IAEA International Atomic Energy Agency

Royal University of Bhutan

SHERUBTSE COLLEGE
KANGLUNG

Online Training in High Energy Physics in Bhutan

Training on data analysis using particle physics data from the ATLAS experiment at CERN

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Celebrating 10 Years of Physics Without Frontiers
22th November 2022

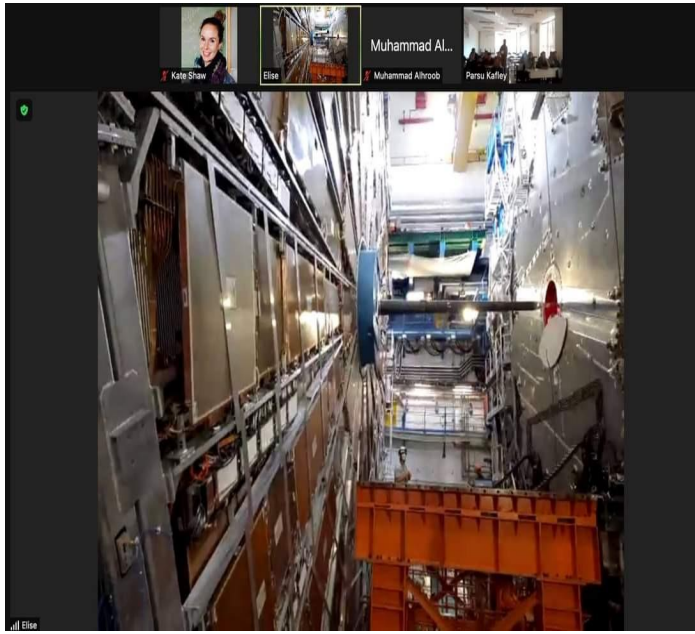
Sherubtse College(RUB)

Status of the Physics Programme in Bhutan-Sherubtse College-Located in Kanglung, Trashigang (first College in Bhutan).

- 1968: Established as Public School and Junior College in 1976 under the university of Delhi.
- 2004: Royal University of Bhutan (10 Colleges)
- ***Only college in Bhutan which offers undergraduate Physics Programme***.
- 2017: BSc in Physics (3 years) programme was started. We mostly teach the fundamentals and Physics as a whole is viewed in theoretical approach.
- What do the students do after graduation
  - Majority of the students try for the Civil Sevice exams.
  - Some join as higher secondary school teachers and others try for a masters programme in India and other parts of the world.

HEP Programme in collaboration with ICTP PWF

- Getting connected to Dr. Kate Shaw was boon for the College.
- Vice Chancellor, Dr. Nidup Dorji met with Dr. Kate Shaw in Thailand sometimes in 2018.
- Likewise we started our converstaion with Dr. Kate Shaw in 2019 and status of the physics programme in Bhutan was discussed.
- Dr. Kate and her team from ICTP, PWF had planned to visit Bhutan to render the support and training to the students and faculty members of Sherubtse but the Covid deteriorated our plan.
- The main objective of ICTP, PWF was to motivate, educate and train the university students studying Physics/Mathematics in the rquired field worldwide, particularly focussing on Science & Technology lagging Countries.
- Thus the online training was initiated.
- The project was intended to provide hands-on training to BSc in Physics students of Sherubtse College, Royal University of Bhutan, on data analysis using data that are/were generated at CERN.
- Students of Sherubtse college attended the programme on collider physics using ATLAS open data.
- Programme was organized by Dr. Kate Shaw-Scientist at ICTP, PWF.
- 16 Students (10 boys & 6 Girls) attended the 16 weeks programme.



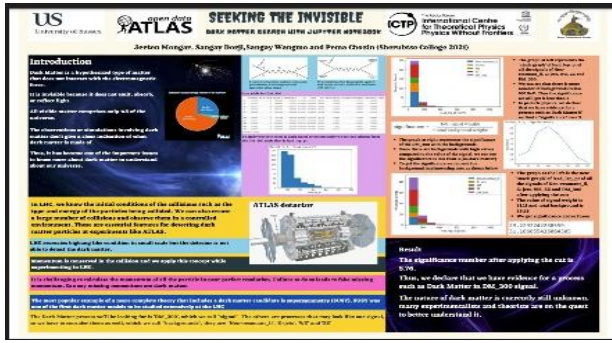
Programmes & Activities

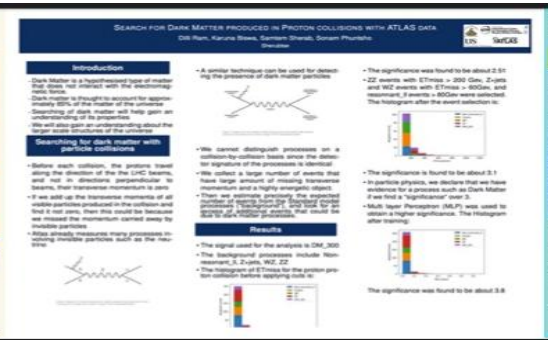
Objectives & Challenges

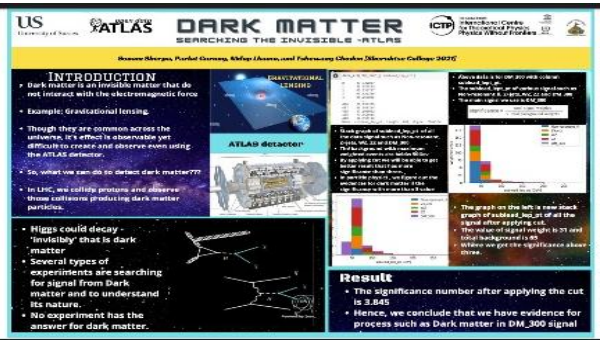
- In this programme, students were trained in particle physics and advanced data analysis using p-p collision data from the ATLAS experiment at CERN.
- The main objective was on data analysis training and to learn the ML concept and apply the cut-based analysis to search for the Dark Matter.
- For the first three sessions, students were introduced to the fundamentals of Python Programming and introduction to Particle Physics.
- There were in total 16 sessions, in which two hours was allocated for each session.
- Students learned to use the tools and perform their final projects to search for the dark matter using cut based analysis and machine learning.
- The only challenges faced by the students was on the use of ML tool.
- After successfully completing the 16 weeks programme, the final findings were presented in the form of Poster.

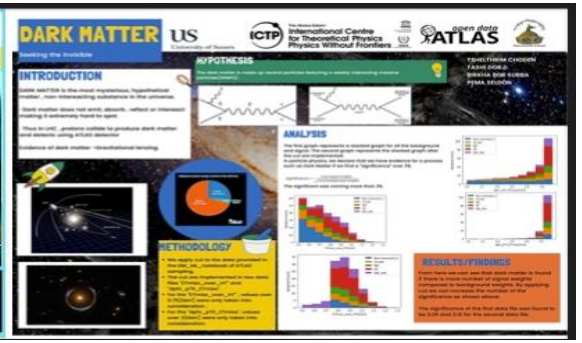
Poster Presentations

Photo session and certificate awards









- Students were overwhelmed attending the programme as they got to learn some basic courses on Particle Physics such as Basic Concepts, Structure of Matter and Fundamental Interactions.
- The use of Machine Learning tools and cut-based analysis was although challenging but was very useful should they plan for the further studies in particle physics related field.
- One of our student expressed that, "**Physics is not only the things we learn in class, it's something more that we can see and apply in the real world**".
- HOD of Science who attended the poster presentation said that, "**Such programme is of first kind in Bhutan particularly in Physics**" and thanked the coordinator for the same expecting similar high level programmes in the near future.

Impact

Students & University

- The impact after attending the program was huge.
- Out of 16 students who attended the programme, ***Four*** are planning for their masters programme in particle related fields , ***two*** are doing intern in Tech Park Bhutan in a programming field(advancing in Python Programming and Machine Learning), ***two*** are working in the autamatic street light controller circuit using Relays & LDR at Sherubtse College, ***some*** are planing to go for the medical physics related fields and the ***others*** are preparing for the Civil Service Exam.

- To understand and determine the most fundamental building blocks of matter and their interactions for the university like ours in extremely important. Students will learn to solve challenging problems in a very competitive environment.

Further Plans with ICTP, PWF

Second phase of the project will be dedicated towards faculties of Physics Program, Sherubtse College and will be provided capacity building training on curriculum development, development of laboratory and research infrastructure/facilities for both undergraduate and masters level.

The faculty members will also be introduced to some of the proper mechanisms for building bilateral cooperation/collaboration with other international academic institutes and industries.

Thank You

Tashi Delek