

NPSS Climate Workshop on Nuclear and Plasma Solutions for Energy and Society



Report of Contributions

Contribution ID: 1

Type: **not specified**

Welcome and Introduction

Sunday 27 October 2024 09:00 (10 minutes)

Presenters: DEL GUERRA, Alberto; DA VIA, Cinzia (University of Manchester (GB))

Contribution ID: 2

Type: **not specified**

A Glaciological Perspective on Climate Change

Sunday 27 October 2024 09:10 (50 minutes)

Climate represents the main driver controlling the growth and demise of Earth's ice masses, which in turn play a major role in many physical and biological processes, including sea level, ocean currents, ecosystems, and climate itself, not to mention human activities. Thus, it is no surprise that shrinking and disappearing glaciers are often referred to as amongst the most dramatic evidence of recent, increased warming. Climate, and hence glaciers, have changed often in historical and geological times. The past evolution of glaciers, and history of glaciations, can therefore be used as a way to decipher past climate changes, essential to contextualise current climatic trends and scenarios, and to refine future predictions. In this talk, Prof. Matteo Spagnolo will use evidence of past glaciations (landforms and sediments), ice cores and other geological climate proxies to present a fascinating historical (hundreds to thousands of years) and geological (10s of thousands to millions of years) overview of what we know about the Earth's climate of the past.

Presenter: Prof. SPAGNOLO, Matteo (Scottish Alliance for Geoscience, Environment and Society The University of Aberdeen)

Contribution ID: 3

Type: **not specified**

Nuclear Fission: Present Status, Challenges and Advanced Reactors

Sunday 27 October 2024 10:00 (50 minutes)

Electricity is the foundation of modern society. New technologies such as electrified vehicles, AI, data centers, and cryptocurrency are driving electricity demand at a rate far exceeding the supply. A mix of energy sources is needed to meet this demand. While renewable energy sources like solar and wind are fast growing, nuclear energy offers unique features that make it a crucial part of the solution. Small Modular Reactors (SMRs) and Microreactors represent an emerging class of nuclear reactors designed for construction on a smaller scale compared to traditional reactors, with current designs capable of generating 50 - 450 MWe and 1 - 25 MWe, respectively. These reactors are highly adaptable and offer numerous advantages for various applications, including data centers, especially when land use and the cost of transmission infrastructure place other energy sources at a disadvantage. Enhanced safety features, such as passive cooling systems and below-ground construction, further bolster their safety profile. Additionally, their smaller size and modularity make them ideal for integration with data centers and microgrid, ensuring a stable and reliable power source, thereby reducing dependence on traditional energy grids and enhancing sustainability. A surge in investment and development in nuclear power production is being observed not only in the USA but also internationally. This talk will begin with a brief review of the history of nuclear power centered on light water reactors, introduce the concept of advanced reactors, and survey the current demands from data centers for microreactors.

Presenter: Prof. CAO, Raymond (Ohio State University)

Contribution ID: 4

Type: **not specified**

The impact of fusion energy on the climate change landscape: are we there yet?

Sunday 27 October 2024 11:10 (50 minutes)

Presenter: Prof. NIETO-PEREZ, Martin (Penn State University)

Contribution ID: 5

Type: **not specified**

Low temperature plasma solutions to climate change: renewable energy, cleaning environment, smart agriculture, and better health

Sunday 27 October 2024 12:00 (50 minutes)

Low temperature plasmas (LTPs) are plasmas with relatively low plasma density and energy (typically <10 eV) have been playing critical roles in technology advancement in microfabrication, light sources, and other established industrial applications. With the versatility and relative low capital cost in the technology development, LTPs present a myriad of opportunities to technology innovation and advancement in identifying solutions to climate change. The research activities that showcase these LTP-based technology developments are categorized as four areas: renewable energy, cleaning environment, smart agriculture, and better health, and are sampled from the LTP community and discussed here.

Presenter: Prof. JIANG, Chunqi (Old Dominion University)

Contribution ID: 6

Type: **not specified**

Accelerators Based Solutions –from Subcritical Reactors to Hadron Therapy & Isotopes

Sunday 27 October 2024 14:00 (50 minutes)

Particle Accelerators for Applications from Medicine to Sub-Critical Reactors

Nuclear power has the benefit of being a carbon-free energy source but generates long-lived radioactive waste and has the potential for impactful accidents. Particle accelerators were developed as scientific instruments but are also being used in industry and medicine. Hadron accelerators are increasingly being used to generate isotopes for nuclear medicine and hadron therapy. In the future, similar accelerators could be used to transmute nuclear waste and drive sub-critical nuclear reactors. Such applications could reduce the probability of severe accidents at nuclear power plants and reduce the long-term impact of the nuclear fuel cycle. This talk will explore the technologies and challenges associated with such applications and will consider some opportunities for future development.

Presenter: Prof. RAUBENHEIMER, Tor (Stanford University)

Contribution ID: 7

Type: **not specified**

Sustainable Computing at Scale

Sunday 27 October 2024 14:50 (50 minutes)

Organizations across the globe are facing growing pressure to address climate change, and companies providing at scale computing services are no exception. The existing cloud services combined with the more recent growth in machine intelligence are rapidly increasing the demand for compute resources and outpacing hardware efficiency improvements. This talk covers carbon emissions from a computer architecture perspective. It examines the emissions associated with at-scale computing – from the manufacturing of the devices to the grids used to power data centers – and provides insight into architectural solutions that may address carbon emissions. The talk concludes with a discussion of upcoming challenges facing the computing industry as sustainable solutions such as renewable energy intersect with an ever-growing power demand from data centers.

Srilatha (Bobbie) Manne is a Senior Fellow in the Research and Advanced Development group at Advanced Micro Devices (AMD). She received her PhD from the University of Colorado, Boulder, and has worked on low-power/high-performance architecture for over two decades in both industrial research labs and product teams at companies such as Microsoft, Meta, Cavium and Intel. More recently, she has investigated efficiency and sustainability in hardware design and at scale computing. She has over 30 publications and is the recipient of the International Symposium on Computer Architecture “Test of Time” award which recognizes papers that had the most impact on the field. She is also a co-inventor on nearly 40 patents pending or granted.

Presenter: Dr MANNE, Shrilatha (Bobbie) (AMD)

Contribution ID: 8

Type: **not specified**

Big Data and High Performing Computing

Sunday 27 October 2024 16:00 (50 minutes)

Continuous advances in electronics technology have finally brought us into the age of “Exascale” computing. One of the next big challenges is the management of the deluge of data that is now being generated in scientific research, observation and simulation. Whether it is the ever expanding study of our Earth’s rapidly changing climate and biology or probing the fundamental structure of matter itself, data are being collected and generated at unprecedented rates.

The US Department of Energy (Office of Science) has begun implementation of a new initiative to integrate the vast research and computational resources under the DOE umbrella to help tackle this data wave and to enhance and accelerate discovery and innovation in order to advance a new open science ecosystem.

Jefferson Lab, in Newport News, Virginia, is a US Department of Energy (DOE) funded national laboratory focused on the study of the basic building blocks of matter (quarks and gluons) and the forces that bind them. JLab is playing a significant role in the new DOE Integrated research Initiative (IRI). Details of this initiative as well as several of the programs under development there will be presented.

David Abbott is a staff scientist at JLab. He has spent the majority of his career in the development of data acquisition systems for nuclear physics research.

Presenter: Prof. ABBOTT, David (Jefferson Lab)

Contribution ID: 9

Type: **not specified**

Q/A Discussion

Sunday 27 October 2024 16:50 (1h 10m)

Contribution ID: **10**

Type: **not specified**

Opening

Sunday 27 October 2024 08:30 (30 minutes)