

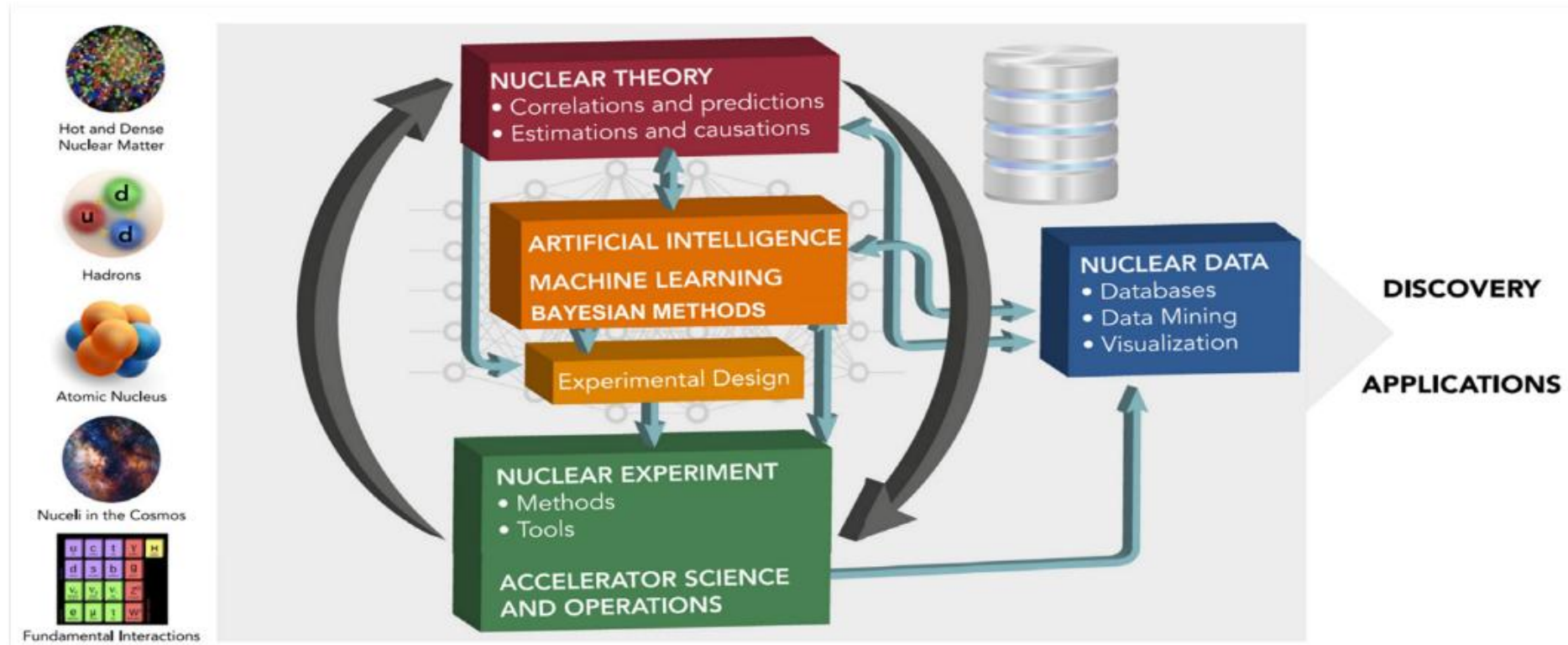
AI/ML needs & expertise in UK nuclear physics

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Nuclear Physics AI vision

Speeding-up *the cycle of the scientific method*



Short Workshop in Derby (March 2024)

With the idea to:

- Meet the ML users in our community
- Get them together to talk about they work and the problems they were solving using the ML.
- Determine how they manage to get started and what solutions they adopted
- What kind of support/training they received.
- What kind of other support they would have like to have when they started (training, network)

Derby workshop programme

13:00 – 13:05 Marc Labiche

Welcome - Introduction 5mn

13:05 – 13:20 Bryan Mckinnon (Glasgow)

“ML/AI implementations at CLAS12” 10+5mn

13:20 – 13:45 Caroline Shenton-Taylor (Surrey)

“AI/ML and Nuclear Applications: Overview of Surrey projects”

13:45 – 14:00 Fraser Holloway (Liverpool)

“Machine Learning and Pulse Shape Analysis for Nuclear Instrumentation” 10+5mn

14:00 – 14:15 Kimberley Lennon (ukaea)

“Machine learning for improvements to nuclear fusion diagnostics” 10+5 mn

14:15 – 14:30 Samuel Sullivan (Surrey)

“Enhancing phenomenological optical model optimisation with a feed-forward neural network”

14:45 – 15:00 Nicodemos (Derby)

“Use of ML in unfolding (inverse problem)”

15:00 – 15:15 Lee Barnby (Derby)

15:15 - 16:00 Discussion

Outcome of the discussion

- Many ML users self taught ML or started with a minimum training.
- They are working mostly in isolation – finding support either amongst colleagues from their own institute or amongst collaborators from the same project.
 - Nothing wrong with that but this could lead to unnecessary duplication.
- Everyone could see benefits of having a network of ML users and a platform to facilitate knowledge exchange:
 - Workshop, conference, training, and online forum.
- Question: how can we best sustain these activities, at the UK level as well as European level?

European initiatives

Very much triggered by ECFA, NuPECC and APPEC.

- In April-May 2024 first “European AI for Fundamental Physics Conference” took place in Amsterdam = EuCAIFCon2024
- Second Conference took place in June 2025 in Cagliari, Sardinia
- Third one is in Heidelberg – 24th-28th of August 2026:
<https://indico.physi.uni-heidelberg.de/event/1277/>
 - Establish new connections between AI activities across various branches of fundamental physics
 - Including theoretical physics, accelerator physics, experimental PP, gravitational waves, astroparticle physics, cosmology and nuclear physics
 - Prepare for the next 10 years – training programme

What next for our community?

Do we continue as we do ?

Should we do more networking on ML within our own community and across communities, both at UK and EU level ?

Can our community take advantage of the UK investment going toward AI/ML development and applications?