

**Krakov School of Interdisciplinary PhD Studies <KISD>**  
invites PhD students and members of the research staff  
to attend the series of guest lectures given by:

## **Professor David Milstead**

**Stockholm University, Sweden**

### **Open Questions in Modern Physics and the Way Forward**

The field of particle physics is currently in a state that is unprecedented in the past 50 years. The Standard Model of Particle Physics has withstood high-sensitivity falsification tests and is now experimentally complete following the discovery of the Higgs boson at the CERN Large Hadron Collider. However, several open questions remain that the Standard Model cannot answer. The lectures will include a general overview of possible options for future colliders, as well as two dedicated talks on searches for new phenomena: magnetic monopoles and baryon number violation. Discoveries in these areas could address key open questions such as the quantisation of electric charge and the origin of the matter-antimatter asymmetry, respectively.

1. **"The hunt for the elusive magnetic monopole. Why and how searches are made?"** Dirac's argument and Grand Unified Theories. Understanding electric charge quantisation. Searches in cosmic rays, at the Large Hadron Collider, and in bound matter. Reports of possible discoveries that could not be reproduced.
2. **"Where to go next in particle physics? A review of collider and non-collider results and options as the European field decides on an updated strategy."** The end of the no-lose theorem in collider physics. The need for high-precision measurements of the Higgs boson. Open questions - such as baryogenesis and the nature of dark matter - that require answers. Making progress through both collider and non-collider approaches.
3. **"Baryon number violation – why it is needed and how it is sought (colliders and non-colliders)."** The necessity of baryon number violation to explain the origin of the matter-antimatter asymmetry. Electroweak baryogenesis. Post-sphaleron baryogenesis. Searches for proton decay, neutron–antineutron conversion, and evidence of baryon number violation in high-energy particle collisions.

***Prof. D. Milstead** received his PhD from the University of Liverpool in 1996. He performed precision measurements of the strong force and a search for magnetic monopoles at the HERA electron-proton collider at DESY in Hamburg. He later moved to Stockholm University and focused on searches for physics processes beyond the Standard Model with the ATLAS experiment at the CERN LHC. His principal interest was the search for hitherto unseen long-lived massive particles. More recently he became co-spokesperson of the HIBEAM/NNBAR collaboration which is designing an experiment to look for matter-antimatter transitions (neutron-antineutron conversions) which could take place at the world's brightest neutron source, the European Spallation Source in Lund, Sweden. Prof. Milstead had produced in collaboration with a BBC TV Team a film "Chasing the Magnetic Monopole". He is an experienced speaker and lecturer in the field of particle physics.*

#### **Schedule:**

- **Thursday, 15.05.2025, 11:00 AM-12:30 PM**  
*IFJ PAN, Auditorium, 1st floor*
- **Friday, 16.05.2025, 10:00-11:30 AM**  
*IFJ PAN, MSD room, 1st floor*
- **Monday, 19.05.2025, 10:00-11:30 AM**  
*IFJ PAN, MSD room, 1st floor*