Working Group on Statistical Learning Seminar

Title: Light entertainment - Spectroscopy of atoms and ions in UCD

Speaker: Fergal O'Reilly (UCD)

Date: Thu 23rd April 2026 at 3:00PM

Location: E0.32 (beside Pi restaurant)

Abstract: Our progress as a species in understanding of light and matter has underpinned a vast swathe of modern technology, from nano-imaging of biological material to microchip production, to unpicking the signals of vastly distant times and places in astronomy. We were led to our quantum-mechanical theories by the existence of light emission and absorption features in atoms that could not easily be explained any other way. While there are only about 100 elements, they have a total of about 5000 ion stages, and they emit and absorb radiation across the entire electromagnetic spectrum. The spectra of each ion stage are unique for each ion stage, and for the environment in which they are born, and are highly complex. The Spectroscopy Group in UCD School of Physics work on understanding these processes, particularly in ions, often using high power lasers to produce short-lived highly ionised fireballs. This spectral data is a critical input to the atomic structure and plasma models that we and others develop, which can then be applied more broadly. The vast majority of our knowledge of the universe comes from stellar spectroscopy, and one of our current major research areas is iterating spectral measurements with atomic models, to help astronomers to untangle the spectral signatures of extreme collision events. We are developing large databases of measured and modelled data, and we are at an early stage of planning in developing data pipelines to make maximum use of these data.