

Career Talks: Physics Panel Speaker Bios

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Sarah Morris, UBC PhD in Medical Physics

Sarah did her undergraduate degree in Physics at the University of Cambridge in England. During the summer vacations she completed internships in a variety of research areas including astrophysics and accelerator physics before choosing a Master's project in magnetic resonance imaging (MRI) research at the University of Cambridge. She enjoyed her Masters project and was excited by the versatility and real-world implications of MRI research and immediately decided to apply for a PhD.

She is currently a 4th year PhD student researching quantitative MRI techniques for measuring tissue microstructural properties in the brain and spinal cord. MRI provides unparalleled *in vivo* soft tissue contrast and is crucial for the diagnosis of many diseases. A variety of advanced quantitative MRI techniques have become available in recent years which can be used to measure myelination, axonal integrity and direction, inflammation, edema and many other tissue properties.

MRI research involves a diverse range of skills including understanding the underlying physics of manipulating proton spins via magnetic fields and RF pulses, scanner pulse sequence programming, image processing and analysis, statistics and well as some understanding of the anatomy and pathology we want to interrogate. Sarah has a particular focus on developing and validating techniques to measure the different types of degeneration which occur after spinal cord injury.

Erik Frieling, UBC PhD in Optics/Atomic Physic

Erik came to UBC from Germany in 2012, and fell in love with the University and Vancouver. After completing his Bachelor's in Honours Physics, he remained at UBC. He is currently a 4th year PhD student pursuing research using ultra-cold atoms at the Quantum Degenerate Gases Lab at UBC.

As the name suggests, ultra-cold atoms are atoms that were cooled to extremely low (less than 10 thousandths of a Kelvin) above absolute zero. This is achieved by manipulating their internal and external degrees of freedom using laser beams and static magnetic fields. "Quantum degenerate" refers to the fact that at these extremely low temperatures, the quantum mechanical size (wave function) of the atoms becomes larger than the space between them. This is called quantum degeneracy. The most famous example of quantum degeneracy is Bose-Einstein condensation, which garnered the first people to achieve it in a lab the Nobel Prize in 2003.

A big motivation in cold atom physics is using the fact that atoms are pretty simple and can be controlled very well to learn more about analogous systems (such as neutrons in a neutron star, or electrons in a superconductor) where observing the particles is much more challenging.

Erik is working on studying the phenomena that occur in mixtures of two different species of cold atoms (Lithium and Rubidium), which obey different quantum statistics (Li is a fermion, Rb is a boson) and have a large mass imbalance (Rb is 15 times heavier than Li).