SEMINAR NOTICE

Department of Physics and Engineering Physics
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SPEAKER: Nathan Nelson, PhD candidate,
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TOPIC: *Dust Injection in STOR-M*

DATE: Tuesday October 8th, 2024

TIME: 3:30-4:30 p.m.

PLACE: ***Physics 103***

Abstract:

The vast majority of energy currently consumed by humanity comes from unsustainable fossil fuel sources. Nuclear fusion is a safe, long-term alternative which can eventually replace fossil fuels by providing power on demand. Currently, the most successful design for a fusion reactor is the tokamak, which is a toroidally shaped magnetic confinement device aiming to implement thermal fusion of a deuterium/tritium plasma. These devices have seen constant improvement since they were first developed around 70 years ago. Today, scientists are challenged by the energetic interactions between the hot plasma contained within a tokamak and the inner wall of the vessel which faces the plasma. A particularly troublesome byproduct of these interactions is nano-micron scaled impurities, known as dust, mainly produced through interactions with the inner wall. If a sufficient amount of in-vessel dust is ever present the plasma will terminate, likely damaging the tokamak due to the abrupt release of energy from the plasma and associated magnetic field onto the vessel. Additionally, dust is a major health and safety concern as it is toxic and may be explosive if contacted with air. As such, dust must be controlled within the machine.

Dust experiments in STOR-M have been conducted using tungsten (currently the leading material used for a tokamaks inner wall) micro-spheres (i.e synthetic dust), a specialized dust injector, fast cameras, ion-Doppler spectrometry, and the many standard diagnostics available on STOR-M. In this experiment, we have quantified the negative effects of synthetic dust on the STOR-M plasma based on its amount and location within the vessel. We have also measured the force which the plasma exerts on dust in the toroidal direction within the core of STOR-M. Using the Hutchinson/Khrapak model for the ion-drag force acting on spherical dust, we recovered the force on synthetic dust particles within a factor of 2 compared to the experimentally determined force. These results indicate that the ion flow within the STOR-M tokamak dominates dust transport within the machine. This may have significant consequences for dust control in modern tokamaks and possibly other fusion devices and as such should be investigated in said devices.

Coffee and cookies available in the physics lounge Phys 177 at 3:00pm for those attending the seminar.