Date:	Friday, 30 November 2018
Time:	11:00 – 12:20
Speaker:	Alexander MILLAR
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## **Directional axion detection**

## **Abstract:**

In the event of a discovery there will be a strong need to extract as much information as possible from the axion signal. How to do this for devices that are directionally insensitive to incoming dark matter axion velocities has been studied. Unfortunately one is limited by this insensitivity. We develop a formalism to describe extensions of existing axion haloscope designs to those that possess directional sensitivity. The effects are measurable if experiments are designed to have dimensions that approach the typical coherence length for the local axion field. With directional sensitivity, axion detection experiments would have a greatly enhanced potential to probe the local dark matter velocity distribution. We develop our formalism generally, but apply it to specific experimental designs, namely resonant cavities and dielectric disk haloscopes. We demonstrate that these experiments are capable of measuring the daily modulation of the dark matter signal and using it to reconstruct the three-dimensional velocity distribution. This allows one to measure the Solar peculiar velocity, probe the anisotropy of the dark matter velocity ellipsoid and identify cold substructures such as the recently discovered streams near to Earth. Directional experiments can also identify features over much shorter timescales, potentially facilitating the mapping of debris from axion mini clusters.

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