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Searching for solar KK axions with a gaseous detector

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In theories with extra dimensions, the standard QCD axion has excited states with higher mass. The axion of such theories, named the Kaluza-Klein (KK) axion, would have a significantly shorter decay time for higher mass states. This would allow for axion decays on Earth, even in the absence of a strong magnetic field. It would also mean that a fraction of heavier mass axions created in the Sun would remain gravitationally trapped in the Solar System, dominating the local density of axions.

NEWS-G is a dark matter direct detection collaboration that aims to detect low mass WIMPs using a gaseous target detector. The detector is a gas-filled metallic sphere with a high voltage electrode in its centre. While WIMP detection is its main purpose, it is also particularly suitable to KK axion detection. Since the rate of KK axion decays depends only on volume, not on mass, the use of a low density target is an asset: it allows to distinguish such decays from the background by identifying the separate location of the capture of the two resulting photons.

In this talk, I will briefly cover the arguments in favour of the existence of (solar) KK axions. Then, I will describe the detector, and how our event discrimination works. Finally, I will present preliminary exclusion limits on KK axion coupling constant to photons, and the data and analysis leading to that limit.

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