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The ORGAN Experiment

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The Frequency and Quantum Metrology Laboratory at UWA is in the process of constructing a haloscope (the Oscillating Resonant Group Axion converter, or ORGAN) designed initially to search for axions around 110 micro-eV, or 26.6 GHz, with the ultimate goal of performing a wide range search above 20 GHz. The primary motivation for this search is a direct test of the Beck result [1], which claims a potential signal due to an axion resonance effect in Josephson Junctions. The proposed signal suggests axions at 26.6 GHz +/- ~500 MHz. The search will consist of several phases, and the initial pathfinding run is currently underway. The pathfinding search consists of a single copper resonant cavity embedded in a 7 T magnetic field at 4 K, employing a traditional HEMT based amplifier and readout via a high-speed digitizer, the detecting mode was chosen to be a TM¬020 mode [2]. We discuss the preparations for this search, as well as the planned future phases and extensions, which includes first results at cryogenic temperatures. We are exploring different mechanisms of cavity tuning, as well as different methods for the power combining and synchronisation of multiple cavities, a common theme in high frequency axion searches. We will discuss novel cross-correlation measurement schemes, which are two channel measurements where signals common between channels are preserved, whilst noise uncommon between channels is rejected. We propose a way to utilize these techniques in multiple cavity axion searches [3].

[1] C. Beck, Phys. Rev. Lett. 111, 231801 (2013) doi:10.1103/PhysRevLett.111.231801 [arXiv:1309.3790 [hep-ph]].

[2] B. T. McAllister, S. R. Parker, E. N. Ivanov, and M. E. Tobar, Proceedings of the 12th Patras Workshop on Axions, WIMPs and WISPs [arXiv:1611.08082 [hep-ex]].

[3] S. R. Parker, B. McAllister, E. N. Ivanov and M. E. Tobar, arXiv:1510.05775 [physics.ins-det]. (update forthcoming)

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