

Searching for Scalar Dark Matter and High Frequency Gravitational Waves with Mechanical Resonators

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High quality factor bulk acoustic wave resonators provide a highly sensitive probe for fundamental physics research, as well as industry timing applications. When applied using the techniques and cryogenic technologies developed in the field of precision frequency metrology, these resonators can be used to place constraints on many emerging physical theories and even potentially detect new physics.

We present the summary of recent experimental work in which such piezo-electric bulk acoustic wave resonators have been used to constrain the parameters space of scalar dark matter using a novel analysis technique. We further show how the same resonator can be used to also search for high frequency gravitational wave (HFGW) signals by presenting our active and experimentally operational HFGW detection experiment: the Multimode Acoustic Gravitational-wave Experiment (MAGE), which has collected 153 days of real data in which rare events were detected. We outline the path for further work in how such resonator technology can be further used to push the boundaries of fundamental physics, exploring even more of Scalar DM parameter space and probing deeper into further new physics with experiment.

Primary author: CAMPBELL, William (The University of Western Australia)

Co-authors: TOBAR, Michael (University of Western Australia); Dr GORYACHEV, Maxim; MCALLISTER, Ben

Presenter: CAMPBELL, William (The University of Western Australia)

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