International Workshop *Searching for Galactic Axions and Superconducting Devices with Quantum Efficiency* October 25-29, 2021, (virtual)

The main aim of the workshop was to bring together and match the efforts of world leading scientists and young researchers working in two separate and challenging fields connected by the emergence of commonly needed technology. Searching for dark matter Axions (the scale of the Universe) and quantum information technology (the microscopic and mesoscopic scales) allowing to develop and realize quantum photon detectors capable of detecting extremely weak electromagnetic signals in the microwave region; discuss the current results, future perspectives and exchange new ideas in quantum metrology with application to axion dark matter search.

In spite of severe time constraints for this on-line event around forty local and foreign scientists participated in the Workshop. During the Workshop twenty scientific talks have been delivered by invited speakers (2 from South Korea, 16-Europe, 1-USA, 1-Australia). The talks focused on recent advances in the detection of the dark matter Axions carried out in the framework of special research programs established in Europe, USA, Australia and South Korea, i.e. ADMX experiment, QUAX, MADMAX Haloscopes, CAPP, etc., and the detection of single microwave photons with high efficiency. In particular, several invited talks were dedicated to the research activity in the framework of the SUPERGALAX HORIZON 2020 FETOPEN Project. In the latter area of research various novel approaches were recognized:

- Coherent superconducting interacting qubits networks
- Josephson parametric amplifiers based on superconductors with high kinetic inductances
- Josephson traveling wave parametric amplifiers
- microwave single photon counters based on a Josephson tunnel junction biased in the MQT (macroscopic quantum tunneling) regime
- coherent magnetic excitations
- entangled microwave photons in ac driven Josephson junctions,

and how these approaches can be used in the dark matter Axion experiments. The colloquium was delivered by Prof. Michael Tobar who spoke about the dark matter Axion studies (experiments and theory) at the University of Western Australia.

The participants representing two scientific communities actively discussed and exchanged novel ideas. We anticipate that these discussions will lead to long-term research projects between various groups. We also received positive feedback from several participants about the quality of organization of the Workshop.

Overall, we met the main goals of the workshop and there is a strong interest in holding an in-person event on the same topic in the future.

Sincerely yours,

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