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First Results of a new Haloscope Setup at Mainz and Prospects for Detecting Ultra High Frequency Gravitational Waves

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We present the first results for a new microwave cavity haloscope based in Mainz, Germany. Over the past 2 years the experiment has been planned, constructed and now yields the first result in the search for dark photons within a frequency range of approximately 0.1 MHz centered around 8.47 GHz.

This result has been achieved by using a NbN-coated superconducting cavity, which differs inherently from the typical HTS approaches utilizing REBCO or YBCO tapes for superconductivity. In this context the entire setup has been characterized with and without application of an external 14.1 T magnetic field for subsequent searches for axions and gravitational waves.

Furthermore we present a new analysis approach to search for high-frequency gravitational waves (GW) emitted by primordial black hole mergers while explicitly taking into account the often overlooked maximum signal duration inherent in these transient events.

This approach allows any RF-cavity based haloscope to participate in a global network collaboration of GW detectors yielding superior sensitivity to transient events with the ability to resolve the direction of the GW source.

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