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A hybrid non-linear cavity-magnon haloscope for quantum sensing of "invisible" axions

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We present a detector for quantum sensing invisible axions which are good candidates for dark matter. This is a tripartite hybrid system combining an antiferromagnet, a superconducting circuit and a 3D microwave cavity. The idea is to hybridize in the ultra-strong coupling regime magnons and photons respectively in the antiferromagnet (a GdVO4 crystal) and the microwave cavity. We demonstrate that we can spectroscopically access the antiferromagnetic resonance in the antiferromagnetic phase using the cavity readout on a frequency range larger than 2GHz. This is enabled by the Kerr non-linearity induced by the superconducting circuit. Both these aspects should enable to sense invisible axions at the quantum limit on a very large mass range.

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