

Proof-of-principle booster setup for the MADMAX dielectric haloscope

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The MADMAX experiment is aimed to directly detect dark matter axions with masses between $40\ \mu\text{eV}$ and $400\ \mu\text{eV}$ by using their conversion to photons at boundaries between materials of different dielectric constants under a strong magnetic field. Combining many such surfaces, this conversion can be significantly enhanced using constructive interference and resonances. We present a first proof-of-principle realization of such a booster system consisting of a copper mirror and up to 5 sapphire disks. The electromagnetic response of the system is investigated by reflectivity measurements. The mechanical accuracy, calibration process of unwanted reflections and the repeatability of the results using basic optimization algorithms to place the disks are investigated. Possible systematics from 3D effects such as tilts are discussed. We find that for the presented cases the electromagnetic response predicted by previous one-dimensional theoretical calculations is sufficiently realized with our setup.

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