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Symmetry Breaking in Haloscope Microwave Cavities

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Axion haloscope detectors use microwave cavities permeated by a magnetic field to resonate photons converted from axions via the Primackoff effect. The sensitivity of a detector is proportional to the coupling of the cavity's search mode to the axion conversion. Transverse symmetry breaking is used to tune the search modes for scanning across a range of axion masses. However, computer simulations show transverse and longitudinal symmetry breaking reduce mode-to-conversion coupling. Simulations also show longitudinal symmetry breaking leads to other undesired consequences like mode mixing and mode crowding. These results further complicate axion dark matter searches, requiring mode identification techniques. The effects of symmetry breaking on haloscope cavity modes will be presented along with mode identification techniques.

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