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The spectral lineshape of gradient-coupled bosonic dark matter in our galaxy

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Virialized bosonic dark matter in our galaxy features a distinct spectral lineshape due to the velocity distribution of its constituents. If it can be resolved in an experiment, its expected evolution during Earth's propagation through the galaxy is a useful systematic check in case of a positive detection and can be used via pattern search algorithms to improve the sensitivity to galactic dark matter in haloscope experiments. If it cannot be resolved the underlying probability density function informs the exclusion power of a given data set. The lineshape depends on the type of interaction between the dark matter and the experimental apparatus. Most of the searches until now have been sensitive to the scalar coupling, for which the lineshape is known. We derive the spectral lineshape of gradient-coupled bosonic dark matter, illustrate differences to scalar coupled experiments and point at novel signatures to search for.

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