

# Self-induced Floquet magnons in magnetic vortices

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We report the discovery of self-induced Floquet magnons in magnetic vortex structures and their electrical detection using MRAM-compatible magnetic tunnel junctions. When driven into steady-state gyrotropic motion, a magnetic vortex acts as a coherent intrinsic periodic drive that Floquet-engineers the magnon spectrum without requiring an external microwave pump. This mechanism gives rise to a tunable magnon frequency comb with equidistant sidebands, originating from the nonlinear coupling between the vortex core motion and higher-order spin-wave modes. Building on these results, we demonstrate direct electrical detection of vortex magnons using nanoscale MRAM cells, where dynamic stray fields modulate the tunnel magnetoresistance and generate rectified voltage signals. The ability to access nonlinear magnons electrically establishes a scalable, CMOS-compatible route for magnonic sensing and signal processing. These findings position magnetic vortices as compact platforms for nonlinear magnonics, Floquet engineering, and integrated spintronic technologies.

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