Rotating optical microcavities with broken chiral symmetry

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We demonstrate in open microcavities with broken chiral symmetry, quasi-degenerate pairs of co-propagating modes in a non-rotating cavity evolve to counter-propagating modes with rotation. The emission patterns change dramatically by rotation, due to distinct output directions of CW and CCW waves. By tuning the degree of spatial chirality, we maximize the sensitivity of microcavity emission to rotation. The rotation-induced change of emission is orders of magnitude larger than the Sagnac effect, pointing to a promising direction for ultrasmall optical gyroscopes.

Rotation Converts Co-propagating modes to Counter Propagating Modes

Change in Farfield Intensity due to Rotation

Tuning Farfield Sensitivity By Tuning Spatial Chirality

The farfield intensity is two orders of magnitude more sensitive than Sagnac effect. The sensitivity can be tuned by tuning spatial chirality which changes the CW and CCW output directions.

The frequency shifts or Sagnac effect due to rotation are similar for a chiral and non-chiral cavity. The maximal chirality leads to largest difference in CW and CCW output directions, making the emission pattern most sensitive to rotation. This process of tuning chirality to enhance farfield sensitivity to rotation does not lead to Q spoiling of the modes of the cavity.

References: