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Backscattering induced by rotation rate in a dispersion assisted micro resonator

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Resonance optical gyroscope (ROG)'s scale factor for measuring rotation rate is enhanced by anomalous dispersion of superluminal light propagation. The effect of dispersion property on linewidth and minimum detectable angular rate of passive ROG are discussed, respectively. Broadened resonant linewidth induced by material dispersion effect in the cavity deteriorates the performance of ROG and counteract dispersion enhancement effect. While the sensitivity of ROG could be enhanced by anomalous dispersion imported by coupled resonators even considering the effect of anomalous dispersion on broadened line width and this could result in at least two orders of magnitude enhancement in sensitivity. A novel self-reference measurement by using mode broadening is proposed to detect the rotation rate in a whispering gallery mode (WGM) resonator with a cavity-made slot filled an atomic vapor. The reflection of the cavity-made slot is sensitive to the rotation via detuning an optical pump rate and a strong driving field coupled to a three-level of atomic vapor. Due to the reflection of the cavity-made slot, the degenerate clockwise and counterclockwise modes couple to each other and generate two new eigenmodes. To detect the mode broadening induced by rotation rate in the cavity-made slotted resonator enable the gyroscope's sensitivity to be enhanced at least five orders of magnitude.

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