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Weak Lasing in Polariton Superlattices

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Abstract

Bosons with finite life-time exhibit condensation and lasing when their influx exceeds the lasing threshold determined by the dissipative losses. In general, different one-particle states decay differently, and the bosons are usually assumed to condense in the state with the longest life-time. Interaction between the bosons partially neglected by such an assumption can smear the lasing threshold into a threshold domain – a stable lasing many-body state exists within certain intervals of the bosonic influxes. This recently described *weak lasing*[1] regime is formed by the spontaneously symmetry breaking and phase-locking self-organization of bosonic modes, which results in an essentially many-body state with a stable balance between gains and losses. Here we report the first observation of the weak lasing phase in a one-dimensional condensate of exciton-polaritons[2] subject to a periodic potential. Real and reciprocal space photoluminescence images demonstrate that the spatial period of the condensate is twice as large as the period of the underlying periodic potential. These experiments are realized at room temperature in a ZnO microwire deposited on a silicon grating. The period doubling takes place at a critical pumping power, while at a lower power polariton emission images have the same periodicity as the grating.

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