

# Equilibrium coherence and persistent circulation of long-lifetime polariton condensates

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We have created a spatially homogeneous polariton condensate in thermal equilibrium. *In-situ*, non-destructive measurement of the coherence allows us to extract the quasicondensate fraction. These measurements reveal a striking  $7/2$  power law for the quasicondensate fraction over nearly three orders of magnitude of density. The same power law is seen in simulations solving the generic two-dimensional Gross-Pitaevskii equation for the equilibrium coherence, showing that it is a universal result. This power law has not been predicted by prior analytical theories; prior measurements of coherence with cold atoms did not have sufficient accuracy to observe it.

In a separate set of experiments, we have shown persistent circulation of a polariton condensate in a ring trap, which is initiated by a short (1-2 picosecond) stirring pulse and then persists without degradation and without any additional stirring for as long as we can measure (14 nanoseconds) in a stable steady state.

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