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Mirrorless Optical Parametric Oscillation in Cold Atoms¹ XI-ANXIN GUO, YEFENG MEI, LUWEI ZHAO, SHENGWANG DU, The Hong Kong University of Science and Technology — We demonstrated a mirrorless optical parametric oscillator (MLOPO) in laser-cooled ⁸⁵Rb atoms with backward four-wave mixing (FWM). Without involving any cavities or spatially distributed linear scatterers, the intrinsic feedback is built up by the backward FWM process with electromagnetically induced transparency (EIT). EIT not only resonantly creates transparency for generated anti-Stokes field but also dramatically enhances the $\chi^{(3)}$ nonlinearity. The pump threshold can be tuned by varying the operating parameters, and we achieved it as low as 15 uW, approaching the lowest record of OPO. The narrowest spectral width of the MLOPO in this work we achieved is 16 kHz for both outputs. For the first time, we observed the transition of photon correlation properties from the biphoton quantum regime (below threshold) to the oscillation regime (above threshold). Our system provides an ideal platform for studying the quantum interactions of MLOPO process in a resonant atomic medium.

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Xianxin Guo
The Hong Kong University of Science and Technology

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