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Rotational symmetry breaking and topological phase transition in the exciton-polariton condensate of gapped 2D Dirac material[1] KI HOON LEE, CHANGHEE LEE, JAE-SEUNG JEONG, HONGKI MIN, SUK BUM CHUNG, Seoul Natl Univ — For the quantum well in an optical microcavity, the interplay of the Coulomb interaction and the electron-photon coupling can lead to the emergence of bosonic quasiparticles consisting of the exciton and the cavity photon known as polariton, which can form the Bose-Einstein condensate above a threshold density. Additional physics due to the nontrivial Berry phase comes into play when the quantum well consists of the gapped Dirac material such as the transition metal dichalcogenide (TMD) MoS2 or WTe2. Specifically, in forming excitons, the electron-photon coupling from the optical selection rule due to the Berry phase competes against, rather than cooperates with, the Coulomb interaction. We find that this competition gives rise to the spontaneous breaking of the rotational symmetry in the polariton condensate and also drives topological phase transition, both novel features in polariton condensation. We also investigate the possible detection of this competition through photoluminescence.

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