Three-photon coherence of Rydberg atomic states

HYO MIN KWAK, TAEK JEONG, YOON-SEOK LEE, HAN SEB MOON, Pusan Natl Univ

We investigated three-photon coherence effects of the Rydberg state in a four-level ladder-type atomic system for the $5S_{1/2}$ ($F=3$) - $5P_{3/2}$ ($F'=4$) - $5D_{5/2}$ - $5P_{3/2}$ transition of $^{85}\text{Rb}$ atoms. By adding a resonant electric field of microwave (MW) at electromagnetically induced transparency (EIT) in Rydberg state scheme, we observed experimentally that splitting of EIT signal appears under the condition of three-photon resonance in the Doppler-broadened atomic system. Discriminating the two- and three-photon coherence terms from the calculated spectrum in a simple four-level ladder-type Doppler-broadened atomic system, we found that the physical origin of splitting of EIT was three-photon coherence effect, but not three-photon quantum interference phenomena such as three-photon electromagnetically induced absorption (TPEIA).