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Two-dimensional atom localization via phase-sensitive absorption-gain spectra in five-level hyper inverted-Y atomic systems ZHONGHU ZHU, WEN-XING YANG[1], Department of Physics, Southeast University, Nanjing 210096, PR China, AI-XI CHEN, Department of Applied Physics, School of Basic Science, East China Jiaotong University, Nanchang 330013, PR China — High-precision measurement of an atomic position through a standing-wave field has been the subject of active research over the past few decades because of its potential applications in laser cooling and trapping of neutral atoms, such as atom nanolithography, Bose-Einstein condensation, and coherent patterning of matter waves. More recently, two-dimensional atom localization, achieved by applying two orthogonal standing-wave fields, has been studied extensively for its unique properties. For realizing high-precision two-dimensional atom localization, we explore two-dimensional atom localization based on phase-sensitive probe absorption and gain in a microwave-driven five-level hyper inverted-Y atomic system. Because of the spatial position-dependent atom-field interaction, two-dimensional atom localization can be achieved by the measurements of the probe absorption and gain spectra. It was clearly shown that the precision of two-dimensional atom localization is extremely sensitive to the detuning of the weak probe field, the intensities of the two control fields, and the relative phase of the driving fields. The main advantage of our proposed scheme is that the maximum probability of finding the atom at an expected position in one period of the standing-wave fields is 100%.

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