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Ground state studies of charmonium via radiative transitions at BESIII

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Charmonium spectroscopy is an ideal tool to systematically study the strong interaction between the fundamental building blocks of matter, quarks and gluons. From a theoretical and experimental point of view, charmonium is considered as one of the most controllable two-quark systems. Hence, precision measurements of the properties of charmonia allow a thorough study of the non-perturbative features of the strong interaction, such as confinement and the dynamic generation of the mass of hadrons. Although all predicted charmonium states below the open-charm threshold have been observed experimentally, our knowledge is surprisingly sparse on the spin singlet S-wave states, including the charmonium ground state, the ηc. Even for the basic properties of this state, such as the mass and lifetime, large discrepancies between various experiments have been observed. Recently, the M1 radiative transition $\psi' \to \gamma\eta_c$ with 6 exclusive decay modes was studied using the largest data sample of ψ' collected with the BESIII detector. For the first time, a large distortion of the line-shape of the ηc was observed which was attributed to an interference between the ηc and a non-resonant background. The presence of such an interference could explain the discrepancies observed between older experiments. In this work, we study the ηc line shape using world's largest data sample of ψ' events which is collected in e+e- annihilations with the BESIII detector at the BEPCII storage ring in Beijing, China, with the aim to provide a detailed study on the origin of the line-shape distortion.

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