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4.36 Fast-framing camera based observations of spheromak-like plasmoid collision and merging process using two magnetized coaxial plasma guns

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We have been conducting compact toroid (CT) collision and merging experiments by using two magnetized coaxial plasma guns (MCPG) [1]. As is well known, an actual CT/plasmoid moves macroscopically in a confining magnetic field [2]. Therefore, three-dimensional measurements are important in understanding the behavior of the CTs. To observe the macroscopic process, we adopted a fast-framing camera developed by NAC Image Technology: ULTRA Cam HS-106E. The characteristics of this camera are as follows; a CCD color sensor, capable of capturing 120 images during one sequence with a frame rate of up to 1.25 MHz. Using this camera, we captured the global motion of a CT inside the magnetic field and the collision of two CTs at the mid-plane. Additionally, by using a color sensor, we captured the global change in plasma emission of visible light during the CT collision/merging process. As a result of these measurements, we determined the CT's global motion and the changes in the CT's shape and visible emission. The detailed system setup and experimental results will be presented and discussed. [1] I. Allfrey et al., Bull. Am. Phys. Soc. 62, BP11.00054 (2017). [2] T. Matsumoto et al., Rev. Sci. Instrum. 87, 11D406 (2016).

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