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Plasma rotation in an experiment of magnetic flux compression by an imploding plasma[1] MARKO CVEJIC, DMYTRY MIKITCHUK[2], PRASHANT SHARMA, EYAL KROUPP, RAMY DORON, YITZHAK MARON, Weizmann Institute of Science, ALEXANDER VELIKOVICH, Plasma Physics Division, Naval Research Laboratory, AMNON FRUCHTMAN, Holon Institute of Technology — The fundamental physics of the plasma rotation in plasma implosion with a pre-embedded magnetic field is investigated within an oxygen gas-puff Z-pinch (0.3-MA, 1-μs long current pulse). Time and space resolved spectroscopy of the polarized Zeeman effect is used to measure, for the first time, simultaneously all three components of the magnetic field together with the plasma rotation velocity obtained from Doppler shifts of spectral lines. The measurements show that an application of an axial magnetic field makes the imploding plasma rotate. The angular velocity of rotation ω is antiparallel to the applied axial magnetic field, Bz. The plasma does not rotate as a solid body. The measured rotational velocity (1-5)$\bullet 10^6$ cm/s is comparable to the peak implosion velocity. The self-generated rotation plays a significant role in both the pressure and energy balance. Spectroscopic measurements of all three components of the magnetic field help elucidate the mechanisms of the plasma rotation, both the jB force and the EB drift. The improved stability of the imploding plasma demonstrates the effect of the plasma rotation on mitigation of plasma instabilities.

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