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P4.2025 Powerful X-ray plasma radiation as a result of high-energy plasma flows collision

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Experimental results related to soft X-ray (SXR) radiation generated during a head-on collision of two low-temperature plasma flows immersed in a longitudinal magnetic field are presented. The plasma flows with velocities of (2-4)x10^7 cm/s and energy contents of 70-100 kJ were produced in these experiments by a pair of counter-facing electrodynamic coaxial plasma accelerators with pulsed gas injection. Nitrogen and neon, as well as their mixtures with deuterium, were used as plasma-forming gases.
Diagnostic equipment is described, and the results obtained under different operating conditions are discussed. Measurements provided by a set of photodiodes covered by different filters showed that SXR (photon energies from 0.4 to 1 keV) pulses with the duration of 10-15 μs and total energy of 2-10 kJ were generated in collisions of two plasma flows. Also, Xray spectroscopy was used to study the high-temperature plasma produced during a collision of these plasma flows. Observed intensities of spectral lines were compared with results of detailed kinetic calculations performed in a steady-state approximation. In the experiments with plasma flows containing nitrogen ions, the electron temperature in a central part of the plasma column was found to be 120-130 eV, whereas in the experiments with neon plasma flows it was at the level of 160-170 eV. At the same time, the temporal evolution of the plasma electron temperature in this cross-section of the plasma volume was determined with help of the absorber foils method based on the X-ray continuum plasma emission registration by the detectors covered by different filters. The plasma electron temperature was at the level of 170-200 eV both in the nitrogen plasma and in the neon plasma.
Also, some preliminary experimental and numerical results concerning plasma flow interaction with a gas jet are reported.
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