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Structure of a collisionless pair jet in a magnetized electron-proton plasma MARK ERIC DIECKMANN, Linkoping University, DORIS FOLINI, cole Normale Suprieure, Lyon, CRAL, UMR CNRS 5574, Universit de Lyon, 69622 Lyon, France , INGRID HOTZ, AIDA NORDMAN, PIERANGELO DELL'ACQUA, ANDERS YNNERMAN, Linkoping University, ROLF WALDER, cole Normale Suprieure, Lyon, CRAL, UMR CNRS 5574, Universit de Lyon, 69622 Lyon, France — We model with a PIC simulation the expansion of a pair cloud into an ambient magnetized electron-proton plasma at rest. The cloud temperature is 400 keV. It has the mean speed 0.9c along the magnetic field direction and a finite extent orthogonal to this direction. The pair cloud piles up the magnetic field into a piston that is strong enough to expel the protons. This piston becomes a discontinuity that separates the protons of the ambient plasma from the pair plasma. We thus observe the early stages of the formation of a pair jet in collisionless plasma. The magnetic field of the discontinuity, which is coherent along the sides of the jet, is in contact with relativistic electrons and positrons. This discontinuity thus becomes a source of synchrotron emissions. Protons are accelerated by the discontinuity to MeV energies and a fast magnetosonic shock forms that separates the outer cocoon of the jet from the pristine ambient plasma. The need to conserve the quasi-neutrality of the plasma lets the head of the jet become a source of energetic positrons. We discuss the implications of our findings for relativistic astrophysical pair jets like those that are emitted by accreting black holes.

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