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Magnetic Field Generation by Relativistic Shear Flows EDISON LIANG, Rice University, MARKUS BOETTCHER, Ohio University, IAN SMITH, Rice University — We report PIC simulation results of magnetic field generation by relativistic shear flows. We find that the shear flow boundary layer in initially non-magnetic shear flows is unstable to the growth of oblique 2-stream and Weibel instabilities near the boundary layer. Such instabilities generate current sheets and loops which eventually form nonlinear ordered structures resembling magnetic flux tubes with alternating polarity, orthogonal to the shear flow direction. Peak magnetic fields can reach almost equipartition values. The size and amplitude of such magnetic structures reach a steady state when the free energy input of the shear flow is balanced by turbulence dissipation. Nonthermal particles are efficiently accelerated, likely by the drift-kink instability, into a power-law energy distribution. These results have important implications for many astrophysical settings, including multi-component blazar jets and gamma-ray bursts. This work was supported by NSF AST0909167 and NASA Fermi grants.

Edison Liang
Rice University

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