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Bulk Comptonization by Reconnection Plasmoids in Black Hole Coronae NAVIN SRIDHAR, LORENZO SIRONI, Columbia University — The typical photon spectrum of accreting X-ray binaries in the hard state is modelled with a non-thermal power-law component. This component is usually interpreted as thermal Comptonization of disk photons by a cloud of trans-relativistic electrons in the disk "corona". However, the electron energization mechanism needed to balance the inverse Compton (IC) cooling remains uncertain. We perform first-principle 2D particle-in-cell simulations of magnetic reconnection—with a wide range of magnetizations ($0.3 \leq \sigma \leq 40$)—in electron-positron and electron-proton plasma, subject to different levels of IC cooling. We find that, for all the magnetizations we explored, the electrons' energy spectra are comprised of a high-energy peak dominated by particles with Lorentz factors of $\gamma \sim \sigma/4$, and a low-energy component populated by cold particles residing inside plasmoids, which move as a bulk at trans-relativistic speeds. For $\sigma \geq 1$, the latter can be fit with a Maxwellian distribution with an effective temperature of $T_{\rm eff} \sim 100$ keV, and so it could play the role of the electron distribution used in thermal Comptonization models. In summary, bulk Comptonization in reconnection may explain the hard state spectrum of accreting X-ray binaries.

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