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Electron Losses in Super-insulated Magnetically Insulated Transmission Lines

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Low-loss or loss-free constant-impedance magnetically insulated transmission lines (MITLs) are well understood and are successfully used on the very largest pulsed-power drivers such as Sandia National Laboratories Z Machine. Next-generation drivers must optimize MITL designs to lower their inductance and increase the current per MITL. Super-insulated MITLs are well understood from a theoretical standpoint for equilibrium electron flow and these MITLs have flow impedances close to the vacuum impedance of the transmission lines. Super-insulated MITLs have relatively low levels of vacuum electron flow and very thin electron sheaths. This MITL theory does not address the electron flow in non-equilibrium MITLs. We describe the use of variable-impedance MITLs to lower the driving inductance of disk MITLs and show the first PIC simulations of such MITLs.

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