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Negative Differential Conductance from Space Charge Limited Currents in Semiconductors ANDREW BROOKS, XIAOGUANG ZHANG, University of Florida — Applying the theory of space charge limited currents (SCLC), we show that negative differential conductance can arise from doubly occupied traps that are nearly degenerate with the bottom of the conduction band. Using degenerate state perturbation theory, the Coulomb energy of the doubly occupied traps is shown to depend on the hybridization with the conduction band states. Initially, when carriers are injected into the solid, traps begin to fill while the conduction band states stay relatively empty and thus accessible to trapped electrons via hopping. Trap and conduction states continue to be filled as current is increased, and the energy of trapped electrons begins to rise. A critical current is reached whereupon a further increase in current leads to a reduction of filled traps (i.e. a reduction of space charge in the solid), and thus a corresponding decrease in voltage. This trend in the current-voltage characteristic curves persists until the bottom of the conduction band has been filled, then voltage rises with current.

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