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Physical origin of the Drude-Smith model for the terahertz conductivity of nanomaterials D. BAILLIE, T.L. COCKER, M. BURUMA, L.V. TITOVA, R. SYDORA, F. MARSIGLIO, F.A. HEGMANN, Department of Physics, University of Alberta, Edmonton, Alberta T6G 2G7, Canada — While the Drude-Smith model has been shown to describe the terahertz (THz) conductivity in a variety of nanomaterials,[1,2] its validity and physicality have been questioned. We present a refinement to the backscattering interpretation of the Drude-Smith model, which is shown to emerge analytically from a structurally confined Drude gas of electrons. In addition, the modified Drude-Smith model agrees with our Monte Carlo simulations of Brownian particles confined to a box and driven by an external THz field. This simple, classical model for electron transport in nanomaterials not only provides an excellent fit to the observed THz conductivity in films of nanogranular VO_2, nanostructured gold, and Si nanocrystals, but also allows for the extraction of meaningful, physically-relevant parameters. Finally, the modified Drude-Smith model as a new effective medium theory is discussed. [1] D G Cooke et al., *Phys. Rev. B* **73**, 193311 (2006). [2] M Walther et al., *Phys. Rev. B* **76**, 125408 (2007).

Tyler Cocker

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