Why is the optical transparency of graphene determined by the fine structure constant?¹ DANIEL E. SHEEHY, Louisiana State University, JO-ERG SCHMALIAN, Ames Lab and Iowa State University — The observed 97.7% optical transparency of graphene [R.R. Nair, et al, Science 320, 1308 (2008)] has been linked to the value $1/137$ of the fine structure constant, by using results for noninteracting Dirac fermions. The agreement in three significant figures requires an explanation for the apparent unimportance of the Coulomb interaction. Using arguments based on Ward identities, the leading corrections to the optical conductivity due to the Coulomb interactions are correctly computed (resolving a theoretical dispute) and shown to amount to only 1-2%, corresponding to 0.03-0.04% in the transparency.

¹This research was supported by the Ames Laboratory, operated for the U.S. Department of Energy by Iowa State University under Contract No. DE-AC02-07CH11358, and by the Louisiana Board of Regents, under grant No. LEQSF (2008-11)-RD-A-10.

Daniel E. Sheehy
Louisiana State University

Date submitted: 18 Nov 2009