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**Negative Compressibility and Charge Partitioning Between Graphene and $MoS_2$ Two-Dimensional Electron Gases**[1] JOHN TOLSMA, Department of Physics, University of Texas at Austin, STEFANO LARENTIS, EMANUEL TUTUC, Department of Electrical Engineering, University of Texas at Austin, ALLAN MACDONALD, Department of Physics, University of Texas at Austin — Electron-electron interactions often have opposite influences on thermodynamic properties of electrons in graphene compared to conventional two-dimensional electron gases (2DEGs), for example by lowering charge and spin-susceptibilities in the graphene case and enhancing them in the ordinary 2DEG case [1]. In ordinary 2DEGs the charge susceptibility diverges at a finite carrier density, below which the compressibility becomes negative. We theoretically explore the influence of this qualitative difference on how charge is partitioned between a $MoS_2$ and a graphene sheet 2DEG when they act as a compound capacitor electrode. Our theory is based on a random phase approximation for charge fluctuations in the 2DEGS and the coupling constant formulation for the ground state energy. We find that in the ideal case the $MoS_2$ 2DEG carrier density jumps immediately to a finite value when it is initially populated and discuss how this effect is moderated by disorder.

[1] Yafis Barlas, T. Pereg-Barnea, Marco Polini, Reza Asgari, and A.H. MacDonald, *PRL* **98,** 236601 (2007).

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