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A model of large volumetric capacitance in graphene supercapacitors based on ion clustering BRIAN SKINNER, University of Minnesota, MICHAEL FOGLER, University of California, San Diego, BORIS SHKLOVSKII, University of Minnesota — Electric double layer supercapacitors are promising devices for high-power energy storage based on the reversible absorption of ions into porous, conducting electrodes. Graphene is a particularly good candidate for the electrode material in supercapacitors due to its high conductivity and large surface area. In this paper we consider supercapacitor electrodes made from a stack of graphene sheets with randomly-inserted "spacer" molecules. We show that the large volumetric capacitances $C > 100$ F/cm^3 observed experimentally can be understood as a result of collective intercalation of ions into the graphene stack and the accompanying nonlinear screening by graphene electrons that renormalizes the charge of the ion clusters.

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