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Electromechanically generating electricity with a gapped-graphene electric generator DONALD DRESSEN, JENE GOLOVCHENKO, Harvard University — We demonstrate the fabrication and operation of a gapped-graphene electric generator (G-GEG) device. The G-GEG generates electricity from the mechanical oscillation of droplets of electrolytes and ionic liquids. The spontaneous adsorption of ionic species on graphene charges opposing electric double-layer capacitors (EDLCs) on each half of the device. Modulating the area of contact between the droplet and graphene leads to adsorption/desorption of ions, effectively charging/discharging each EDLC and generating a current. The flow of current supports a potential difference across the G-GEG due to the device's internal impedance. Both the magnitude and polarity of the induced current and voltage show a strong dependence on the type of ionic species used, suggesting that certain ions interact more strongly with graphene than others. We find that a simple model circuit consisting of an AC current source in series with a resistor and a time-varying capacitor accurately predicts the device's dynamic behavior. Additionally, we discuss the effect of graphene's intrinsic quantum capacitance on the G-GEG's performance and speculate on the utility of the device in the context of energy harvesting.

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