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Topologically Frustrated Bonding in Dual-sided Adsorption to an Atomically Thin Membrane CHENG-ING CHIA, VINCENT CRESPI, Department of Physics, Pennsylvania State University — A seamless sp2 atomically thin layer cuts space in half, and prevents penetration of atoms through the sheet, while still allowing cross-sheet charge transfer. This geometrical frustration separates charge donating (e.g. alkali) and charge accepting (e.g. halogen) ions in opposite subspaces and generates a collective planar dipole. In this unusual geometry we observe new physics and chemistry. For graphene layer the uncompensated Coulomb interactions generate a system with multiple nearly degenerate structures which are either metallic or small-gap semiconductors, in contrast to the insulating behavior of unfrustrated salt crystals. When the layer is changed to h-BN, the collective dipole imposes a large Stark effect on the halogen and alkali-derived valence and conduction bands, resulting in a large band gap tuning with areal adsorbate density.

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