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Long-Range Repulsion Between Spatially Confined van der Waals Dimers MAINAK SADHUKHAN, ALEXANDRE TKATCHENKO, University of Luxembourg — It is an undisputed common wisdom that non-retarded vdW interactions between two objects in vacuo are inherently attractive. The universality of vdW attraction is attributed to the dipolar coupling between fluctuating electron charge densities. Here we demonstrate that the long-range interaction between spatially confined vdW dimers becomes repulsive when accounting for the full Coulomb interaction between charge fluctuations. Our analytic results are obtained by using the Coulomb potential as a perturbation over dipole-correlated states for two quantum harmonic oscillators embedded in spaces with reduced dimensionality, however the long-range repulsion is expected to be a general phenomenon for spatially-confined quantum systems. The emergence of repulsive van der Waals interaction due to spatial confinement rationalizes recent observations of anomalously strong screening of the lateral vdW interactions between aromatic hydrocarbons adsorbed on metal surfaces [1] as well as the surprising increase of water flow-rate inside carbon nanotubes with the decreasing tube radius [2]. [1] C. Wagner et al, Phys. Rev. B. **81**, 035423 (2010)[2] A. Michaelides, Nature **537**, 171 (2016).

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