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The physics of the quantum vacuum is not an esoteric subject but is important in practical applications, because it dominates the forces of electrically neutral objects at the nanoscale. In our work, we study ideas for turning the normally attractive force of the quantum vacuum into a repulsive one [1], which could lead to friction-less bearings or novel non-sticky surfaces. We investigate the effect of motion on vacuum forces [2], the question whether the quantum vacuum causes friction, and we analyze the foundations of the underlying Lifshitz theory [3]. The quantum vacuum also plays an important role in cosmology, in cosmic inflation and in the Hawking radiation of black holes. We are involved in an experiment for measuring Hawking radiation in optical analogues of black holes [4].

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