Raising the prospects for quantum levitation

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More than half-a-century ago, the Dutch theoretical physicist Hendrik Casimir calculated that two mirrors placed facing each other in a vacuum would attract. The mysterious force arises from the energy of virtual particles flitting into and out of existence, as described by quantum theory. Now Norio Inui, a scientist from the University of Hyogo in Japan, has predicted that in certain circumstances a reversal in the direction of the so-called Casimir force would be enough to levitate an extremely thin plate. His calculations are published in the American Institute of Physics' (AIP) *Journal of Applied Physics*.

The Casimir force pushes identical plates together, but changes in the geometry and material properties of one of the plates can reverse the direction of the force. Inui calculated that a nanometer-thick plate made from a material called yttrium iron garnet (YIG) could hover half a micrometer above a gold plate. One key finding is that the repulsive force increases as the YIG plate gets thinner. This is convenient since the weight of the plate, and hence the magnitude of the force needed to levitate it, shrinks in tandem with the thickness. Right now the levitating plates exist solely in the theoretical realm.

As a next step, many key assumptions in the calculations will need to be experimentally tested. If the models stand up to further scrutiny, possible applications could include levitating the gyroscopes in micro-electro-mechanical systems (MEMS) and keeping the various components of nanomachines from sticking together.

More information: "Quantum Levitation of a Thin Magnetodielectric

Plate on a Metallic Plate Using the Repulsive Casimir Force" by Norio Inui et al. is published in *Journal of Applied Physics.*
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