Abstract:

Present experimental limits allow for undiscovered forces in nature several million times stronger than gravity acting over distances resolvable by the unaided eye. Theoretical models developed over the past few decades that attempt to unify gravity with the other fundamental forces in nature make specific predictions of additional fundamental forces in the sub-millimeter range. We describe an experimental search for these forces, using 1-kilohertz planar oscillators as test masses with a thin shield between them to suppress backgrounds. This technique has demonstrated the capability to probe micron-scale distances using relatively large masses, and to operate at the limit of instrumental thermal noise at room temperature. A new search for spin-dependent forces, using spin-polarized test masses with essentially zero intrinsic magnetism, will also be described.