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Multidimensional cut-off technique for Casimir energy of massless scalar fields with applications to Bose-Einstein condensates[1] ARIEL EDERY, Bishop's — Quantum fluctuations of massless scalar fields represented by quantum fluctuations of the quasiparticle vacuum in a zero- temperature weakly-interacting dilute Bose-Einstein condensate (BEC) may well provide the first experimental arena for measuring the Casimir force of a field other than the electromagnetic field. This would constitute a real Casimir force measurement–due to quantum fluctuations–in contrast to thermal fluctuation effects. We develop a multidimensional cut-off technique for calculating the Casimir energy of massless scalar fields in d-dimensional rectangular spaces with arbitrary lengths. We explicitly evaluate the multidimensional remainder and express it in a form that converges exponentially fast. Most importantly, we show that the division between analytical and remainder is not arbitrary but has a natural physical interpretation. The analytical part can be viewed as the sum of individual parallel plate energies and the remainder as an interaction energy. The results are applied to the Casimir force in a zero-temperature weakly-interacting dilute BEC.

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