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Macrorealism Emerging from Quantum Physics CASLAV BRUKNER, Faculty of Physics, University of Vienna, Boltzmanngasse 5, 1090 Vienna, Austria, JOHANNES KOFLER, Institute of Quantum Optics and Quantum Information, Boltzmanngasse 3, 1090 Vienna, Austria — I will give a novel theoretical approach to macroscopic realism and classical physics within quantum theory. While conceptually different from the decoherence program, it is not at variance with it. It puts the stress on the required precision of our measurement apparatuses such that quantum effects can still be observed. In the first part of the talk I will show that for unrestricted measurement accuracy a violation of macrorealism (i.e., a violation of the Leggett-Garg inequalities) is possible for arbitrary large systems. In the second part, I will show that, given the restriction of coarse-grained measurement resolution, not only macrorealism becomes valid but even the classical Newtonian laws emerge out of the quantum laws. Thus, even if an object were sufficiently isolated from its environment to avoid decoherence and fully obeys the laws of quantum physics, it will appear to behave classically under coarse-grained measurements. In the final part of the talk I will argue that since larger and larger systems require better and better measurement precision to see quantum effects – and infinite precision cannot be reached in a world with finite resources –, there could be a fundamental limit on the dimensionality of the object above which its quantum features cannot be observed.

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