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New bounds on macroscopic scalar-field topological defects from non-transient signatures due to environmental dependence and spatial variations of the fundamental constants[1] YEVGENY STADNIK, Kavli IPMU, University of Tokyo — I point out that in models of macroscopic topological defects composed of one or more scalar fields that interact non-gravitationally with standard-model fields via scalar-type couplings, the previously overlooked "back action" of ambient matter on the scalar field(s) produces an environmental dependence of the fundamental constants of nature as well as spatial variations of the fundamental constants in the vicinity of dense bodies such as Earth due to the formation of a "bubblelike" defect structure surrounding the dense body. I have derived bounds on non-transient variations of the fundamental constants from torsion-pendulum experiments that search for equivalence-principle-violating forces, experiments comparing the frequencies of ground- and space-based atomic clocks as well as ground-based clocks at different heights in the recent Tokyo SKYTREE experiment, and measurements comparing atomic and molecular transition frequencies in laboratory and low-density astrophysical environments. My newly derived bounds on scalar-field domain walls are significantly more stringent than previously reported bounds, including bounds from clock-based searches for passing domain walls via transient signatures, under the same set of assumptions. Reference: [Stadnik, PRD 102, 115016 (2020)]

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