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Origin of nontopological soliton dark matter

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Nontopological solitons with large global charges and masses, even above the Planck scale, can form in the early universe and dominate the dark matter abundance. In solitosynthesis, solitons prefer to grow as large as possible under equilibrium dynamics when an initial global charge asymmetry is present. Their abundance is set by when soliton formation via particle fusion freezes out, and their charges are set by the time it takes to accumulate free particles. I discuss improvements to the estimation of both quantities, and in particular show that much larger-charged solitons form than previously thought. The results are estimated analytically and validated numerically by solving the coupled Boltzmann equations. Without solitosynthesis, phase transitions can still form solitons from particles left inside false-vacuum pockets and determine their present-day abundance and properties. Even with zero charge asymmetry, solitons formed in this way can have very large charges on account of statistical fluctuations in the numbers of (anti)particles inside each pocket.

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