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Numerical study of the scaling of magnetic monopoles

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Magnetic monopoles are a common prediction of early universe phase transitions. In particular, any type of a grand unified theory phase transition will produce magnetic monopoles, and it is thought that these monopoles would come to dominate the energy density of the universe. This consitutes the 'monopole problem' of grand unification, which theories of inflation solve by diluting the energy density of monopoles sufficiently.

We study the evolution of a system of monopoles numerically, in a case where the monopoles do not interact with other matter. During radiation era, we find evidence that the monopoles annihilate sufficiently fast to maintain a constant energy fraction, while in matter era the density fraction decreases slowly. While our results suggest that a gas of monopoles after a phase transition will not come to dominate the energy density of the universe, further work is needed to see if thermal velocities reduce the annihilation frequency.

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