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Cosmological Implications of Electroweak Monopole

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We discuss the importance of the electroweak ("Cho-Maison") monopole and emphasize that the detection of this monopole, not the Higgs particle, should be the final and topological test of the standard model. If discovered, it should become the first magnetically charged stable topological elementary particle in the history of physics. Moreover, it has deep cosmological implications. It could become the seed of the premodial blackholes and large scale structure of universe, the source of the intergalactic magnetic field, and generate the electroweak baryogenesis. To show this we discuss the cosmological production of the electroweak monopole and estimate the remnant monopole density at present universe. We confirm that, although the electroweak phase transition is of the first order, it is very mildly first order. So the monopole production comes from the thermal fluctuations of the Higgs field after the phase transition, not the vacuum bubble collisions during the phase transition. Moreover, while the monopoles are produced copiously around the Ginzburg temperature $T_G \simeq 59.6$ TeV, most of them are annihilated as soon as created. As the result the remnant monopole density in the present universe becomes very small, of 10^{-11} of the critical density. We discuss the implications of our results on the ongoing monopole detection experiments, in particular on MoEDAL, IceCube, ANTARES, and Auger.

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