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Einstein-Cartan gravity: Electroweak Symmetry Breaking, Inflation and Dark Matter

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It is well-known since the works of Utiyama and Kibble that the gravitational force can be obtained by gauging the Lorentz group, which puts gravity on the same footing as the Standard Model fields. The resulting theory - Einstein-Cartan gravity - happens to be very interesting. First, it may generate the electroweak symmetry breaking by a non-perturbative gravitational effect. In this way, it does not only address the hierarchy problem but opens up the possibility to calculate the Higgs mass. Second, the model incorporates inflation at energies below the onset of the strong-coupling of the theory. Finally, it inevitably contains a four-fermion interaction that originates from torsion associated with spin degrees of freedom. This interaction leads to a novel universal mechanism for producing singlet fermions in the Early Universe. These fermions can play the role of dark matter particles. The mechanism is operative in a large range of dark matter particle masses: from a few keV up to ~10^8 GeV.

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