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Ab-initio calculation of the neutron-proton mass difference

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The difference between the masses of the neutron and the proton is only 0.14% of their average. Yet this difference has important implications for the existence and stability of ordinary matter. After explaining how electromagnetic and mass isospin breaking effects can be included in lattice QCD computations, I will show how this mass difference arises from a subtle cancellation of these two effects. I will also report on results for splittings in the Σ , Ξ , D and Ξ_{cc} isospin multiplets, some of which are predictions. As will be explained, the results are obtained from an ab-initio calculation in full lattice QCD plus QED, that includes the effects of non-degenerate up, down, strange and charm quarks in the sea.

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