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Anomaly-free chiral fermion sets and gauge coupling unification

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We look for minimal chiral sets of fermions beyond the Standard Model that are anomaly-free and, simultaneously, vector-like particles with respect to color SU(3) and electromagnetic U(1). We then study whether the addition of such particles to the Standard Model particle content allows for the unification of gauge couplings at a high energy scale, above 5.0x10ˆ15 GeV so as to be safely consistent with proton decay bounds. The possibility to have unifcation at the string scale is also
considered. Inspired in grand unified theories, we also search for minimal chiral fermion sets that belong to SU(5) multiplets, restricted to representations up to dimension 50. It is shown that, in various cases, it is possible to achieve gauge unifcation provided that some of the extra fermions decouple at relatively high intermediate scales.

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