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Neutron Majorana mass from exotic instantons

A Majorana mass for the neutron could result from non-perturbative quantum gravity effects peculiar to string theory. In particular, 'exotic instantons" in un-oriented string compactifications with D-branes extending the (supersymmetric) standard model could indirectly produce an effective operator $\delta m\, n^t n + h.c.$ In a specific model with an extra vector-like pair ofquarks', acquiring a large mass proportional to the string mass scale (exponentially suppressed by a function of the string moduli fields), δm can turn out to be as low as $10^{-24} - 10^{-25}\,\mathrm{eV}$.

The induced neutron-antineutron oscillations could take place with a time scale $\tau_{n\bar{n}} > 10^8 s$ that could be tested by the next generation of experiments.
On the other hand,
proton decay and FCNC's are automatically strongly suppressed and are compatible with the current experimental limits.

Depending on the number of brane intersections, the model may also lead to the generation of Majorana masses for R-handed neutrini.
Our proposal could also suggest neutron-neutralino or neutron-axino oscillations, with implications in UCN, Dark Matter Direct Detection, UHECR and Neutron-Antineutron oscillations.

This suggests to improve the limits on neutron-antineutron oscillations, as a possible test of string theory and quantum gravity.

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