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Constraints on Very Special Relativity from the Electron's gyromagnetic factor

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In 2006, A. Cohen and S. Glashow presented for the first time the idea of Very Special Relativity (VSR), where they imagined to restrict space-time invariance to a subgroup of the full Lorentz group, usually the subgroup $SIM(2)$. The advantage of this theory is that, while it does not affect kinematic predictions of Special Relativity, it is able to explain the existence of neutrino masses without the addition of new exotic particles or tiny twisted space dimensions, which until now have not been observed in experiments yet.
Furthermore, the addition of either P, CP or T invariance to $SIM(2)$ symmetry enlarges the total symmetry group again to the full Lorentz group, implying a natural explanation of the smallness of neutrino's masses in the framework of the CP-violating Standard Model.
Consequences of VSR have already been considered in a large variety of fields, starting from Supersymmetric extensions and getting to the Gravitational sector, Quantum Electrodynamics and much more.
The final goal of this work is to put bounds on some specific Very Special Relativity (VSR) parameters by using the extremely accurate measurement of the Electron's g-factor in Penning trap's experiments.
To do that, we start by considering the corrections arising from the SIM(2) invariant realization of Very Special Relativity to the energy spectrum of a [illegible]−invariant Dirac Fermion in a static and homogeneous magnetic field $\vec{B}$. First, we analyze the case of $\vec{B}$ parallel to the spatial VSR preferred direction $\vec{n}$, finding that the expression for the energy spectrum stays the same, except for a mass shift arising from the VSR contribution. Then, we relax the parallelism condition, finding a new equation for the energy spectrum. We solve this equation perturbatively.
Aiming at comparison with Penning trap's experiment, we derive the first order VSR corrections to the electron's $g-2$ factor. Finally, using the most accurate electron's g-factor measurements in these experiments, we obtain an upper bound to the VSR electron mass parameter, and therefore also to the VSR electronic neutrino mass, of $1eV$. This result does not contradict the possibility for VSR to be the origin of neutrino masses.

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