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Testing Lorentz invariance in weak decays

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Lorentz invariance is the invariance of physical laws under boosts and rotations. It is a key assumption in Special Relativity and the Standard Model of Particle Physics but has not been investigated in detail in the weak interactions. At the Van Swinderen Institute in Groningen a theoretical and experimental research program was started to study Lorentz invariance violation (LIV). The theoretical work led to a framework allowing a systematic approach to search for LIV in weak decays. Based on various experiments limits were set on parameters that quantify LIV. A novel beta decay experiment was designed which tests rotational invariance. Specifically, the dependence of the lifetime of polarized ^{20}Na atoms on the polarization direction was measured as a function of sidereal time. The experiment sets a limit 2×10^{-4} at 90% C.L. on sidereal variations of the relative lifetime. The experimental method and results will be discussed within the context of the theoretical framework.

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