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# Neutrino Force and Its Implications for Atomic Measurement of the Weinberg Angle

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The Standard Model predicts a long-range force mediated by a pair of neutrinos, commonly referred to as the "neutrino force". This force scales as $G_F^2/r^5$, where $G_F$ is the Fermi constant. However, this scaling breaks down at distances $r$
$lesssim\sqrt{G_F}$, where the four-Fermi approximation becomes invalid. In this talk, I present a complete expression for the neutrino force that is valid at all distances. We examine its implications for atomic parity violation (APV) experiments, emphasizing that the neutrino force, due to its long-range nature relative to atomic scales, cannot be treated as a simple correction to the tree-level $Z$-exchange without accounting for atomic wavefunctions. Applying our result to muonium and positronium, we find that the neutrino force contributes approximately 4 % and 16 %, respectively, compared to the leading $Z$-exchange contribution. These findings have important consequences for the detection of the neutrino force and precision measurements of the weak mixing angle.

## Mini Symposia (Invited Talks Only)

## Plenary (Invited talks only)

**Authors:** Mr YU, Bingrong (Cornell University); SIENG, Chinhsan (Cornell University); GHOSH, Mitrajyoti (Florida State University); GROSSMAN, Yuval (Cornell University)

**Presenter:** SIENG, Chinhsan (Cornell University)

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