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Improved test of the standard model of elementary particles with atomic parity violation[1] KYLE BELOY, Univ. of Nevada, Reno, SERGEY PORSEV, Petersburg Nuclear Physics Institute, ANDREI DEREVIANKO, Univ. of Nevada, Reno — Atomic parity violation places powerful constraints on new physics beyond the Standard Model (SM) of elementary particles. The measurements are interpreted in terms of the nuclear weak charge, quantifying the strength of the electroweak coupling between atomic electrons and quarks of the nucleus. We report the most accurate to-date determination of this coupling strength by combining previous measurements by the Boulder group with our high-precision calculations in cesium atom. Our result is in a perfect agreement with the prediction of the SM. In combination with the results of high-energy collider experiments, our work confirms the predicted energy dependence (or "running") of the electroweak interaction over an energy range spanning four orders of magnitude (from ~ 10 MeV to ~ 100 GeV) and places new limits on the masses of extra Z bosons (Z'). Our raised bound on the Z' masses carves out a lower-energy part of the discovery reach of the Large Hadron Collider. At the same time, a major goal of the LHC is to find evidence for supersymmetry (SUSY), one of the basic, yet experimentally unproven, concepts of particle physics. Our result is consistent with the R-parity conserving SUSY with relatively light (sub-TeV) superpartners. This raises additional hopes of discovering SUSY at the LHC.

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Kyle Beloy
University of Nevada, Reno

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