

Relativistic Many-Body Theory of Parity Nonconservation in Heavy Ions

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By quantifying the strength of the electroweak coupling between atomic electrons with up (u) and down (d) quarks in terms of the nuclear weak charge (Q_w), it is possible to probe physics beyond the standard model (SM) of elementary particle physics. Novel methods of measuring parity nonconservation (PNC) in singly charged trapped and laser cooled ions, possibly Ba^+ and Ra^+ , using table-top experiments have been proposed. These experiments in combination with high precision atomic calculations have the potential to give sub-one percent accuracy results for Q_w . A discrepancy between this value of Q_w and that obtained from the SM is a signature of new physics beyond the SM. The focus of my talk will be on the recent progress in the relativistic many-body theory of PNC in heavy ions. The subtle interplay between the electrostatic interactions in these ions and the weak interactions between the nucleus and the electrons will be highlighted. Results for PNC observables in Ba^+ and Ra^+ and associated properties will be presented.