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Suppression of quasielastic electron scattering cross sections at small q and extraction of the Coulomb Sum Rule

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We report on a phenomenological analysis of all available electron scattering data on carbon (about 8000 differential cross section measurements) and oxygen at all values of q. The QE cross section is modeled within the framework of the superscaling model (including Pauli blocking). In addition to the expected enhancement of the transverse QE response function we find that at low values of q there is "Extra Suppression" of the QE longitudinal response function beyond the expected suppression from Pauli blocking. We extract q dependent parameterizations that can be used to determine the "Extra Suppression" factor for any nucleon momentum distribution for use in electron and neutrino Monte Carlo generators. We obtain the best measurement of the Coulomb Sum Rule (CSR) as function of q. For carbon, the CSR and low q suppression are in good agreement with the Lavato 2000 "First Principle" Green's Function MC. The extracted CSR and low q suppression values for Carbon are in good agreement with the "first principle Green's function MC" calculation of Lavato et al. Phys. Rev. Lett. 117, 082501 (2016). The extracted CSR values for Oxygen are in agreement with the Coupled Custer calculation of J. E. Sobczyk et al. .Phys. ReV. C 102, 064312 (2020). The contribution of nuclear excitations to the Coulomb Sum Rule is significant (up to 29%). Consequently we also provide parameterizations of the form factors for the nuclear excitations in carbon$ and oxygen}

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