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Contribution ID: **2322** Type: **Poster Competition (Graduate Student) / Compétition affiche (Étudiant(e) 2e ou 3e cycle)**

POS-48 Precision Calculation of Parity Violating Asymmetry in Search of New Physics

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My research is part of an effort by the broader subatomic physics community to understand the fundamental characteristics of particles and their interactions. Currently, the Standard Model of particle physics encompasses the knowledge in this field, developed over the last 60 years. As modern technologies and improved experimental techniques develop, measurements become more precise and may show inconsistencies or new phenomena that are not included in our models. The Q-weak experiment at Jefferson Lab has measured the parity-violating asymmetry (ALR) in polarized electron-proton scattering. Specifically, the determination of the proton's weak charge and the weak mixing angle will be extremely precise at very low momentum transfer (Q2) and forward scattering angles.
The goal of our research is to improve the accuracy of theoretical predictions for the fundamental interactions between electrons and protons. Each type of interaction corresponds to a mathematical expression with a parameter that gauges the interaction strength, and may be represented using a so-called Feynman diagram. The interaction strength varies with the energies of the interacting particles, due to processes in which multiple gauge particles are exchanged at one time (i.e. radiative corrections). The full theoretical calculations should account for radiative corrections to the leptonic and hadronic currents, as well as bremsstrahlung.
The mixing of both the electromagnetic force and the parity-violating weak force creates an asymmetry, resulting in different reaction cross sections (i.e. probabilities) depending on the helicity of incident electrons. Our research will focus on one-loop calculations, and involves radiative corrections to the leptonic current, parameterizing the relevant hadronic form factors, and systematically calculating the various Feynman diagrams. The results would improve the accuracy in calculations of the electro-weak interaction, and the coupling strength between the photon and Z-boson gauge particles. We also investigate how the addition of a new theoretical exchange particle (Z') affects the calculated asymmetry (ALR) for polarized electron-proton scattering. Our goal is to test the limits of the Standard Model in search of new physics by performing high precision calculations of ALR and comparing to recent experimental measurements.

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Session Classification: PPD Poster Session & Finals: Poster competition and Mingle session with Industrial partners/employers (5) | Session d'affiches PPD et finales: Concours d'affiches et rencontres avec partenaires industriels et employeurs (5)

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