

ABSTRACT

We propose to measure elastic electron ^3He and ^4He scattering to the highest momentum transfers possible, limited by a cross section sensitivity of about $2 \times 10^{-42} \text{ cm}^2/\text{sr}/\text{MeV}$. The measurements will extend our knowledge of the magnetic form factor of ^3He and the charge form-factor of ^4He down by two orders in magnitude and out in Q^2 possibly by a factor of two. The required incident beam energies range from 0.43 to 4.0 GeV. The scattered electrons will be detected in the Hall A High Resolution Spectrometer. A high-pressure, high-power target system of gas ^3He and ^4He with 25 cm long cells will be used. Good missing mass resolution will provide a clear separation from inelastic processes. The results are expected to play an important role in the understanding of the few-body structure at short distances and its description in terms of mesonic currents and/or quark and gluon-exchanges. We request 53 days of data taking at a current of $100\mu\text{A}$ and 7 days of checkout at low current, in a continuous two-month period or two one-month periods for each isotope.