

Theoretical Uncertainties in Mott Scattering

– as understood by Allena

Mott scattering – electron scattering from nuclei

Calculations provided by Xavier & Chuck:

- DWBA for elastic electron scattering from Au and Ag
 - scatt angle in deg (th)
 - differential cross-sec (dS in cm^2/rad)
 - spin rotation functs (T and U)
 - Sherman Funct (S)
- Uncertainties
 - Numerical accuracy
 - Center of mass
 - Bremsstrahlung
 - Radiative corrections
 - Finite nucleus vs point nucleus
 - Screening of atomic electrons

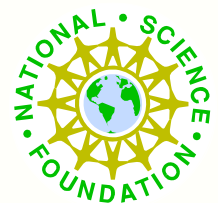


2013-oct-30



Uncertainties – page 1

- Numerical accuracy
 - arises from convergence of the partial wave series
 - can be estimated by Xavier
- Center of mass
 - kinematic and dynamic corrections due to recoiling nucleus
 - kinematic corrections – can be accounted for
 - dynamic corrections – due to change in phase shift of outgoing electron
 - change in scat amps proportional to (m_e/m_N)
 - change in diff cross sec scales with $X (\propto Z m_e/m_N) (m_e/E_e)$ ie small effect
- Bremsstrahlung
 - may be accounted for in G4
 - generally, $E_{\text{rad}} < m_e c^2$ in elect frame or $< \gamma (m_e c^2)$ in lab frame
 - energetic e and heavy nuclei increase this radiation



Uncertainties – page 2

- Radiative corrections
 - “thought to be not relevant for parity conserving analyzing power”
 - Xavier can check this though
- Finite nucleus and point nucleus
 - both calcs can be done
 - but for few MeV electrons, details of nucl charge distrib not relevant
 - might use experimental charge densities parameterized with simple forms for calcs with finite size of nucleus considered
- Screening of atomic electrons
 - can be taken into account
 - But can be neglected for electrons with $E > \text{few MeV}$



2013-oct-30



Bottom Line

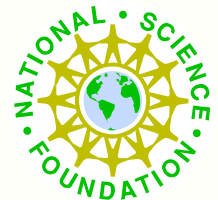
Should try to understand **dynamic recoil effects**

If electron beam with $E = \text{few MeV}$ used \rightarrow

should use medium-mass nuclei targets

because some corrections increase with

(m_e/m_N) and/or (αZ)



2013-oct-30

