Photon Scattering from the Proton

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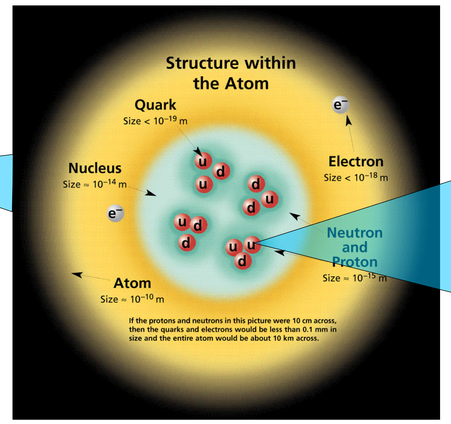
Modern Physics View of Particles

Newton's apple



What do we "see" inside of the atom nowadays?

What is the structure of proton? How does it interact with the other particles?

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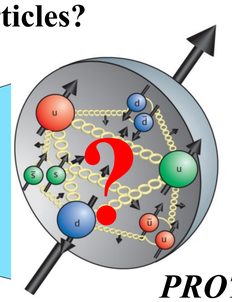
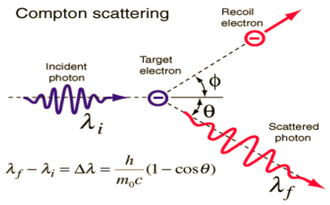


PROTON

"a good way to find out about the internal structure of the proton is to look at it"(Bjorken & Paschos, 1969)

Compton Scattering

Compton Scattering is named after professor A. H. Compton from the Washington University who first measured photon-electron scattering in 1922.



The *Compton effect* for the first time clearly illustrates the particle concept for the electromagnetic radiation.

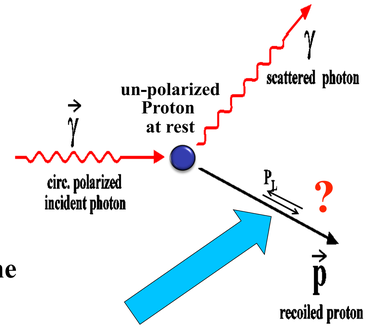
Compton Scattering from the proton

Why do we choose Compton Scattering?

Photon is the best understood particle and the Compton Scattering is the simplest reaction.

Why do we study the spin effect?

The spin effect gives us additional view of the internal structure of the proton.



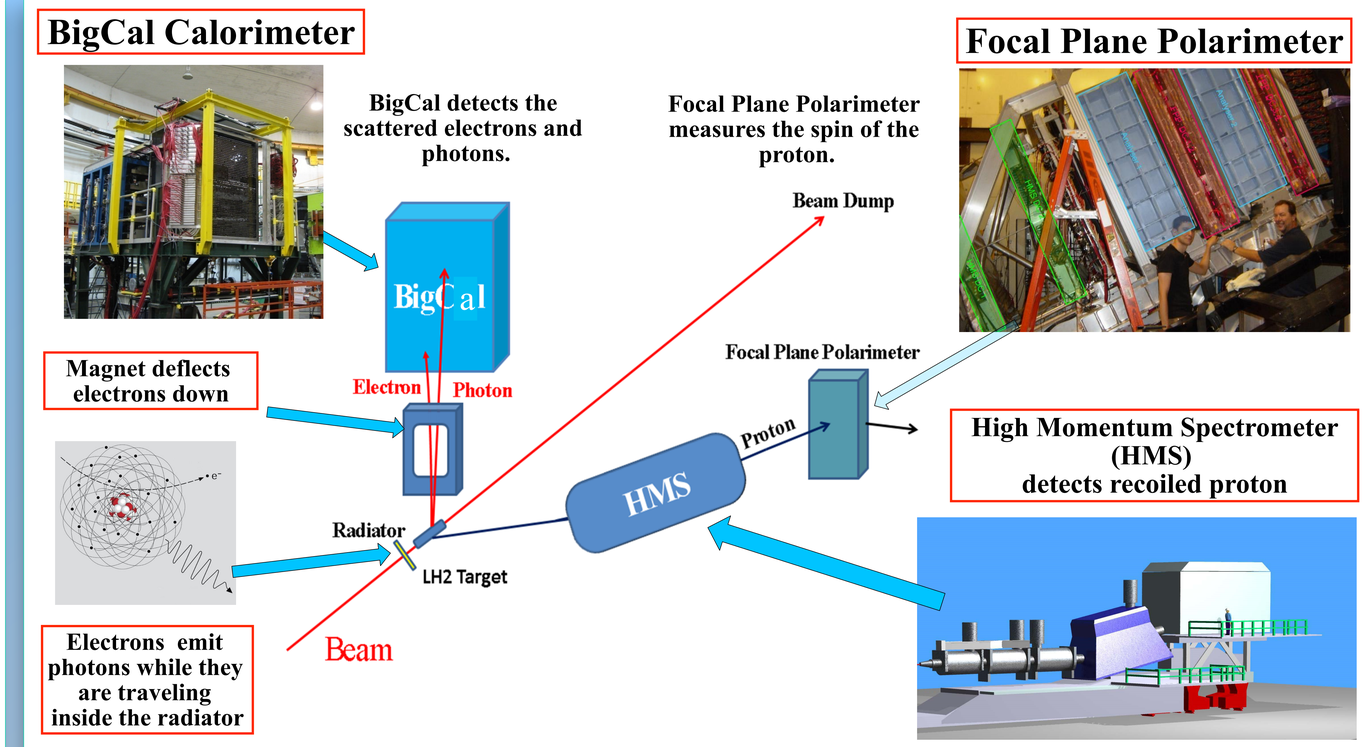
We measure the spin direction of the recoiled proton.

Is the spin direction along the proton momentum or reverse? We use the results to understand the interaction between photon and proton.

Scheme of Experiment at Jefferson Lab

What makes CEBAF the best place to study the Compton Scattering ?

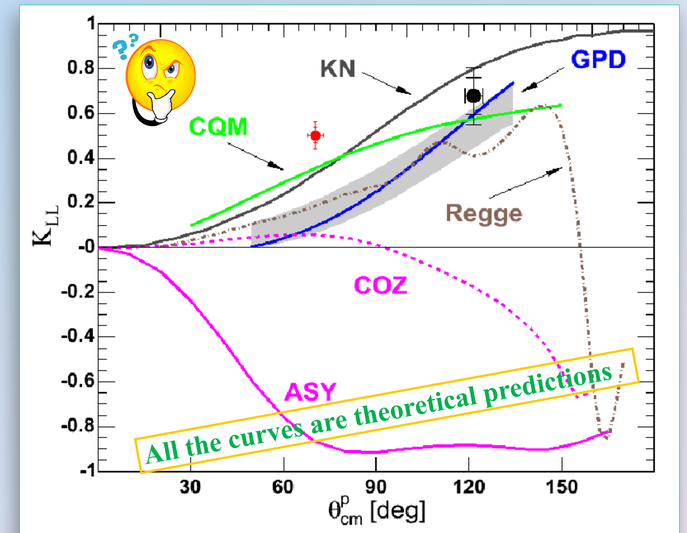
- High intensity, polarization and precision beam
- A mixed photon/electron beam and a magnet which deflects scattered electrons
- High Momentum Spectrometer with large acceptance and good momentum resolution
- Calorimeter(BigCal) measures scattered photon angle with high resolution.
- The focal plane polarimeter measures scattered proton spin with high efficiency



The experiment achieved 1,200 times higher yield than the previous one.

Spokespeople: C. Hyde, R. Gilman, A. M. Nathan and B. Wojtsekhowski

Results



K_{LL} – the probability of having the spin of the proton polarized along its momentum.

the data from the first measurement in Hall A

the data from the new measurement in Hall C

Modern(GPD) theories agree with the Hall A data point. But the new Hall C result disagrees with any theoretical prediction. Currently theorists are investigating how the new data will impact the view of the proton's internal structure.