Phys 256 Lecture 3

There are 5 hats : 3 black 
2 white 

Leonard, Daniel, Alexei stay in line, so that Leonard sees D & A, Daniel sees A
A does not see anybody.

The game is to tell with 100% probability which color of the hat a person wears

1) L is asked "what is your color":
"I cannot answer for sure!"

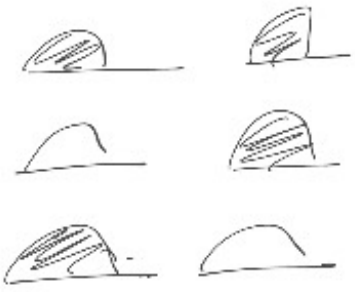
2) D is asked "what is your color":
"I cannot answer for sure!"

3) A says: "I know which one I wear!"

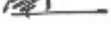
What is his hat color?

A:  black

If L saw 2 white ones 
when he would know for sure that his is black 

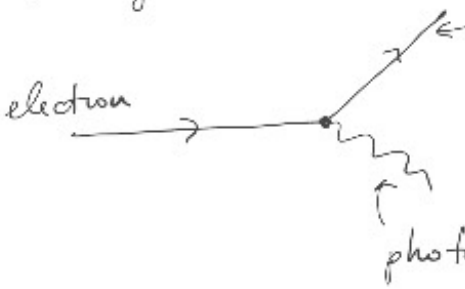
=> he saw 

D A

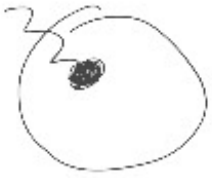
If D saw  when he would know for sure that his was  => he saw  which is the color of Alexe is het

Now I would like to discuss how experimental measurements reveal internal structure of the nucleon:

Suppose we accelerate electrons and scatter them off a target material that is composed of protons

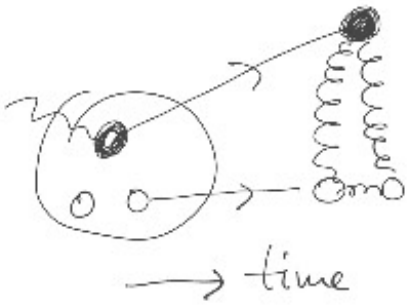


The photon then will encounter a quark inside of the proton (provided that the wave length of the photon is short enough)



The quark will experience a kick from the photon and will fly away from the proton (imaging scattering of billiard balls)

Now there's something interesting happens: the quark still interacts with the remaining quarks inside of the proton



gluons do not let the quark escape. The gluon "flux tube" is created.

A special mechanism then is triggered and the tube starts breaking and producing new particles. (Think of $E = mc^2$ relation, photon has a lot of energy and it transforms into mass)

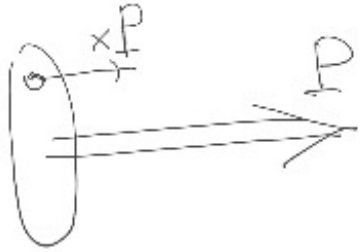
What are particles produced? There are 2 types of particles that are produced then:

mesons → particles made up of a quark and anti-quark

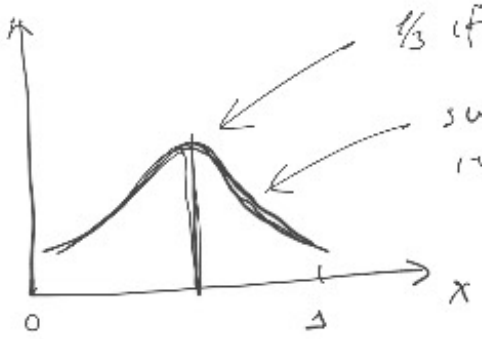
baryons → particles made up of three quarks (such as proton and neutron)

What are the questions that can be answered using the data?

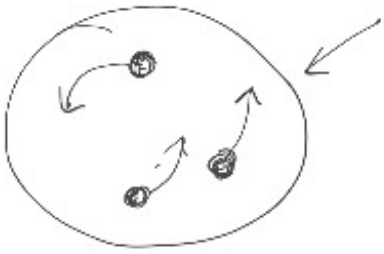
First of all one can figure out the fraction of proton's momentum carried by the quark:



this fraction „x" can be from 0 to 1

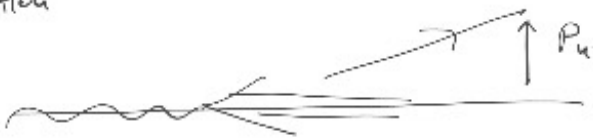


Another thing we can learn is how quarks move inside of the nucleon



Are there any effects on the proton structure due to the quark motion?

Suppose we measure number of particles in the transverse direction



by this transverse momentum is produced by transverse motion of quarks

The first exercise:

take the file cleo_data.dat and find a way in Python to transform it into excel

Use Pandas foundation.