Phys 29C Lecture 2

1) Probability:

You have 50 white balls ○
50 black balls ●

And 2 buckets

You should use all 100 balls and place them in the buckets in such a way that after you close your eyes, buckets are moved around. You should maximize the probability of picking a white ball from a bucket

Solution:

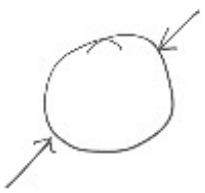
Place 1 white ball in a bucket and 99 balls in the other one

now you have 50% chance of picking the bucket with the white ball. If not you have 50% (49/50 in fact) chance of picking the white ball from the other bucket.

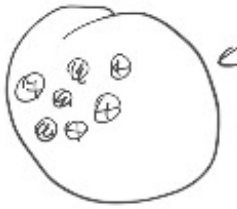
Thus

$$p_{white} = 0.5 + 0.5 \cdot 0.5 = 0.75 \text{, or } 75\%$$

In this course we would like to study the nucleon: proton or neutron



10^{-15} m, proton +1 charge (in terms of electron charge)
neutron 0 charge

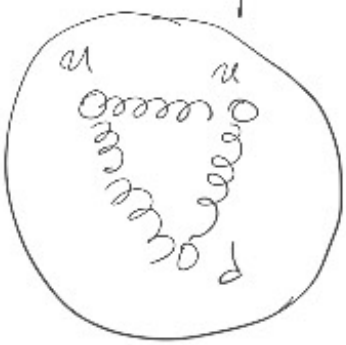


for the nucleon to be stable one has to have another force, not only electric force
This binding force is called „strong force"

Electric force is carried by photons „~~~"
→ electrically neutral, only one type

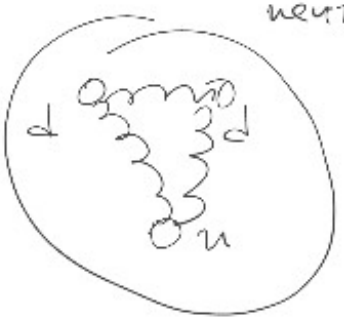
Strong force is also called „Quantum Chromo Dynamics"
The proton is made of quarks (with fractional charges)

proton



$u \to +2/3$
$d \to -1/3$
} $u+u+d = +1$

neutron



$d+d+u=0$

The force carrier is gluon or rather 8 species of gluons that carry "color" charge, electrically neutral

The gluon can "split" into quark-antiquark pair

$\bar{u}$ has $-\frac{2}{3}$ charge