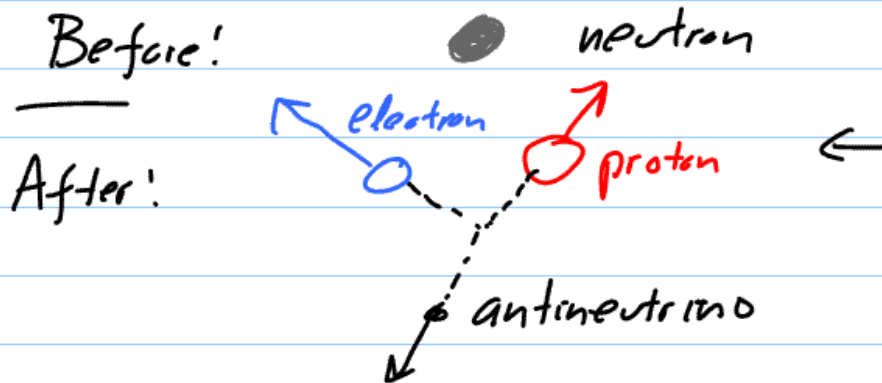


PHY100S - The Magic of Physics - Class 22

"If Shiva were teaching at Princeton, he'd teach quantum mechanics and have a minor in philosophy." -- John Scott

Isolated neutron

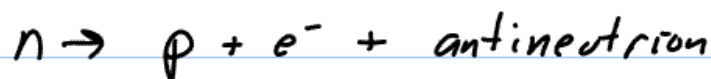


Lifetime \sim 15 minutes

Phosphorus 32!

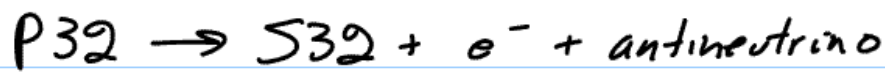
15 protons \leftarrow determines the chemical element
17 neutrons

neutrons unstable



decay product: \rightarrow 16 protons
16 neutrons

Sulfur - 32

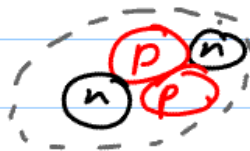


Lifetime \sim 14 days

Radioactive Decay

decay products

α



β

electron, positron

γ

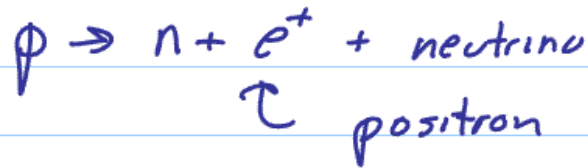
photons

Isolated proton? Appears to be stable

Expt 2003! Lifetime proton

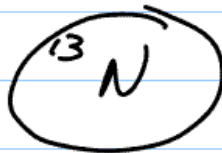
> 4 000 ... 000 years
23 zeroes

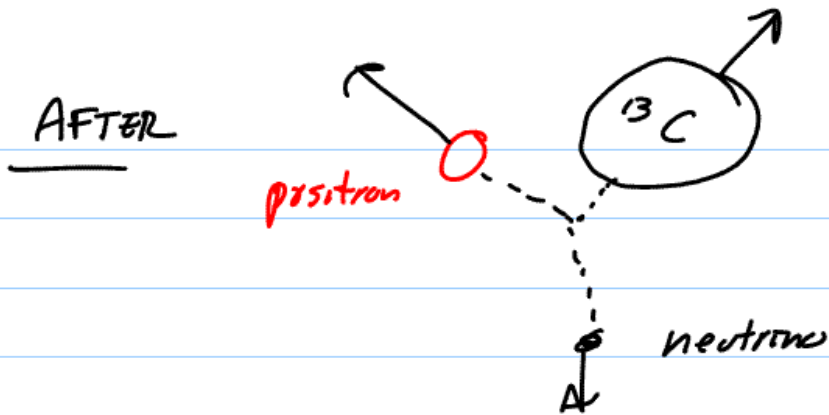
In some nuclei:



| | | |
|-------------|-------------------------|--------------------------|
| Nitrogen-13 | 7 protons 6 neutrons | Lifetime ~ 10 minutes |
| Carbon-13 | 6 protons 7 neutrons | <u>~ 10 minutes</u> |

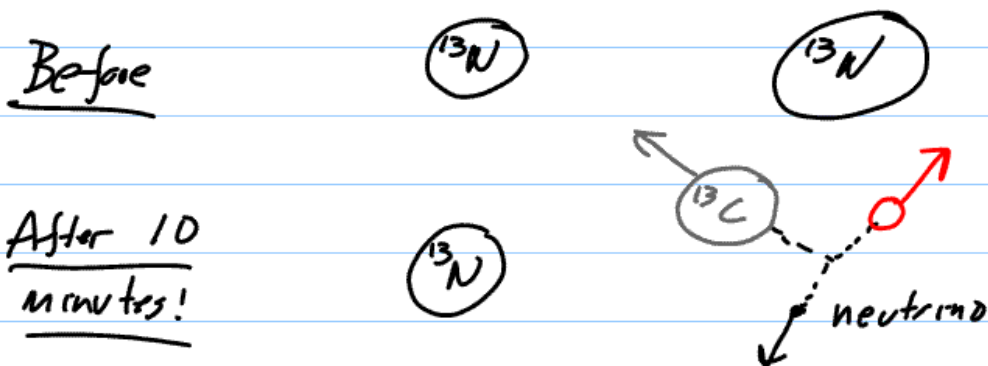
BEFORE





Half-life of Nitrogen-13 is
10 minutes.

| time | N | |
|------------|----|----------------------|
| 0 | 29 | heads- did not decay |
| 10 minutes | 14 | decay |
| 20 mins | 5 | Tail- did decay |



What was the difference
before?

QM! None!

Bohm must be "hidden variables"
inside the ^{13}N nuclei

Schrödinger (1935):

one ^{13}N atom

detector - tells when it decays

releases poison gas when it
detects a decay.