Ch 13

Note Title 10/19/2005

Ch 12 homework posted after class due Monday next week

look for recognizable M+ attributes

Nuclear magnetic resonance spectroscopy

NMR studies resonance of nuclei

(IR: resonance of bonds)

^{1}H (proton)

^{13}C - carbons

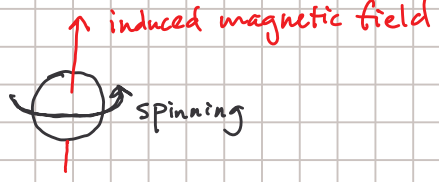
(^{15}N, ^{19}F, ^{31}P also occasionally used)

nuclear spin

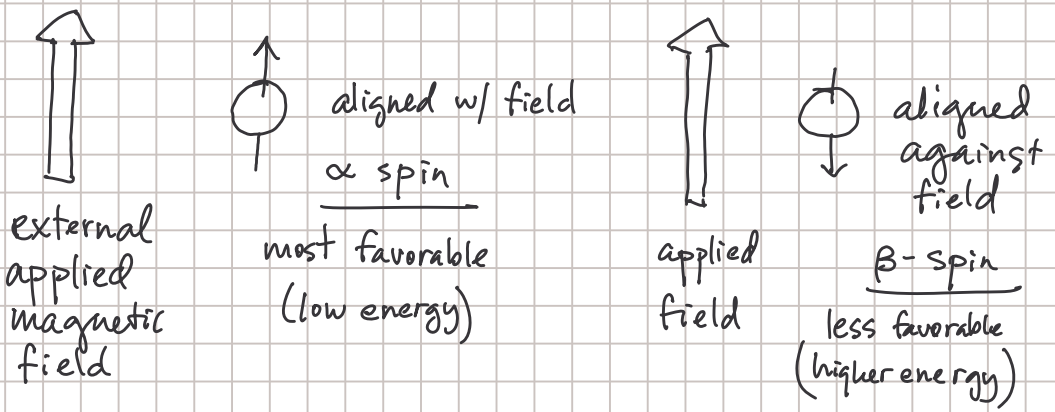
certain nuclei spin about an internal axis

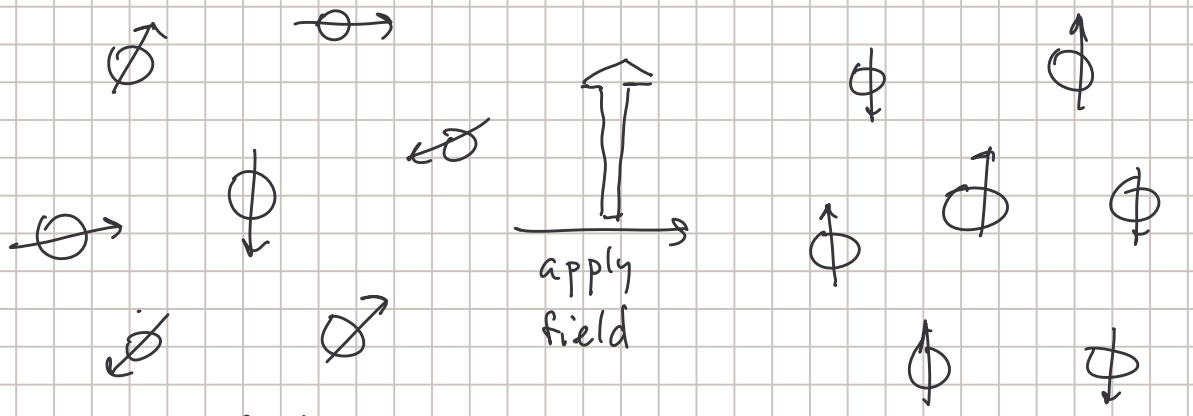
(only nuclei w/ odd mass #)

nuclear spin induces a magnetic field



If an external magnetic field is applied, the nuclei will align themselves either with or against the magnetic field.

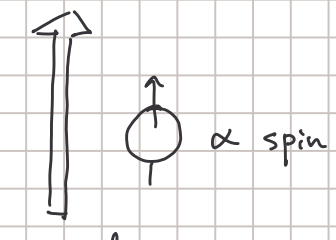


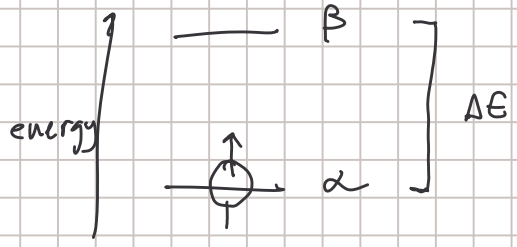


no applied field
spins in random directions

slight majority of spins aligned with field
minority aligned against

Overall, most α & β spins cancel e/o out
still a majority of α leftover

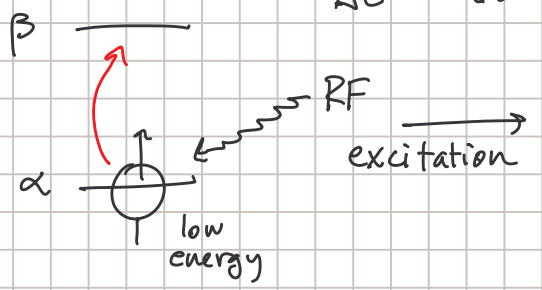


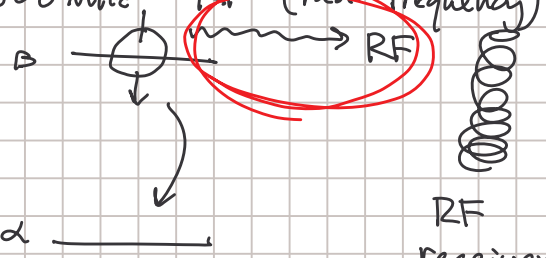


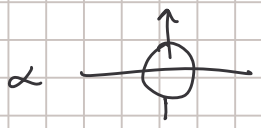
if ΔE is applied to α, it will flip to β

$\Delta E \sim 60-800$ Mhz

RF (radio frequency)

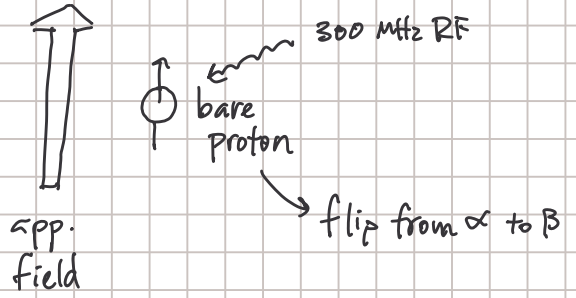


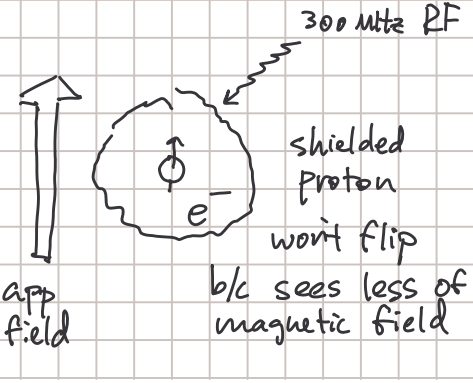


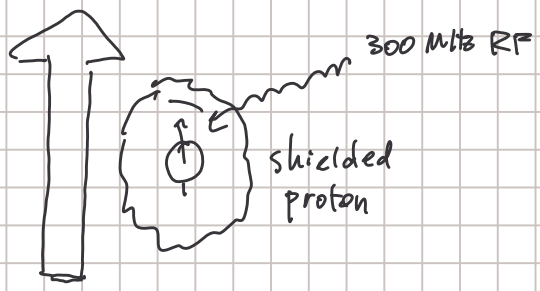


Shielding

lets just talk about protons.

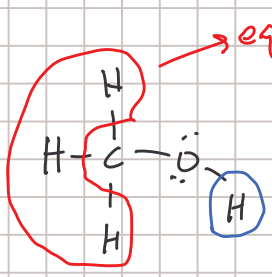






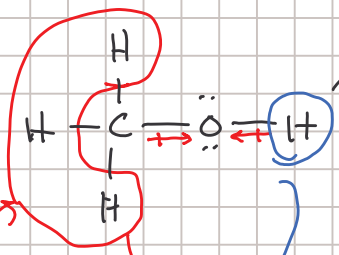
STRONGER applied field ⟶ now the nucleus will flip. (α to β)

Shielded protons require a stronger magnetic field in order to flip



methanol

2 types of protons in CH_3OH

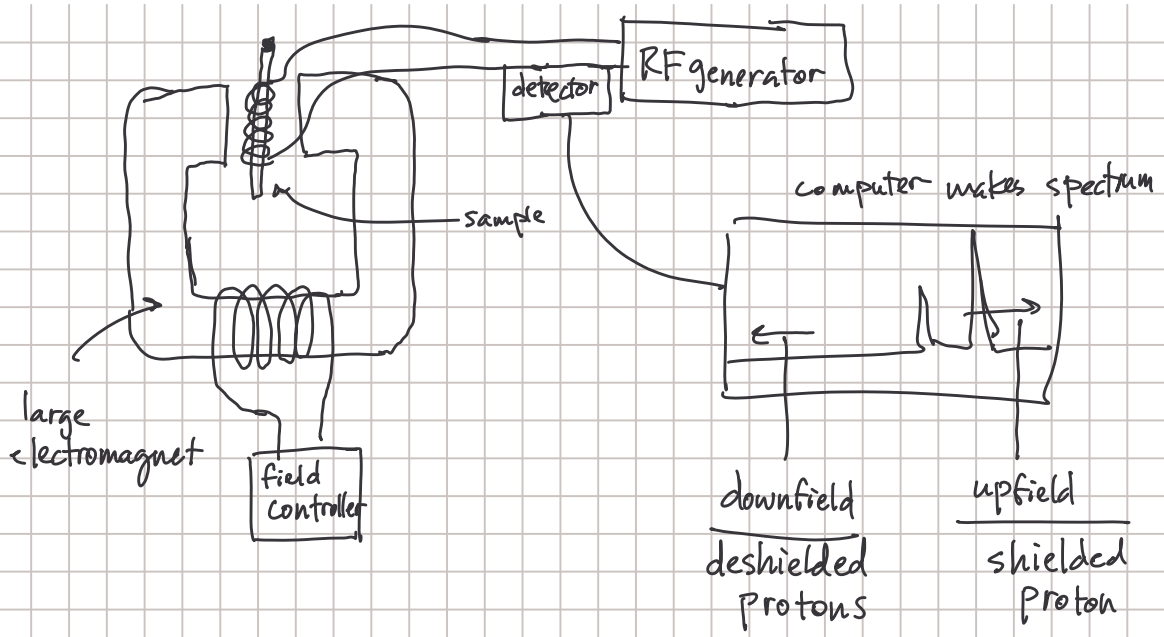


this H is more bare (exposed to effects of magnetic field)

deshielded
weaker magnetic field

more shielded
stronger magnetic field

NMR Spectrum



the OH proton resonance is downfield of the CH_3 proton resonances, because the OH proton is more deshielded