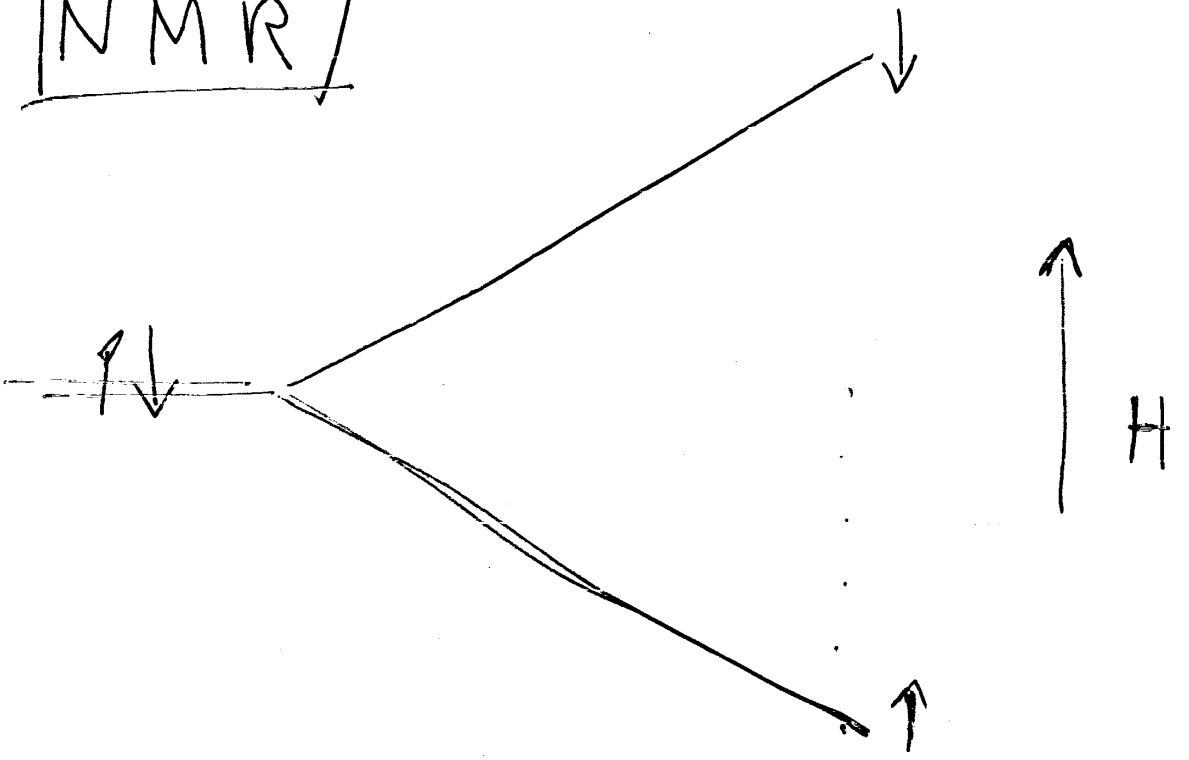
NMR

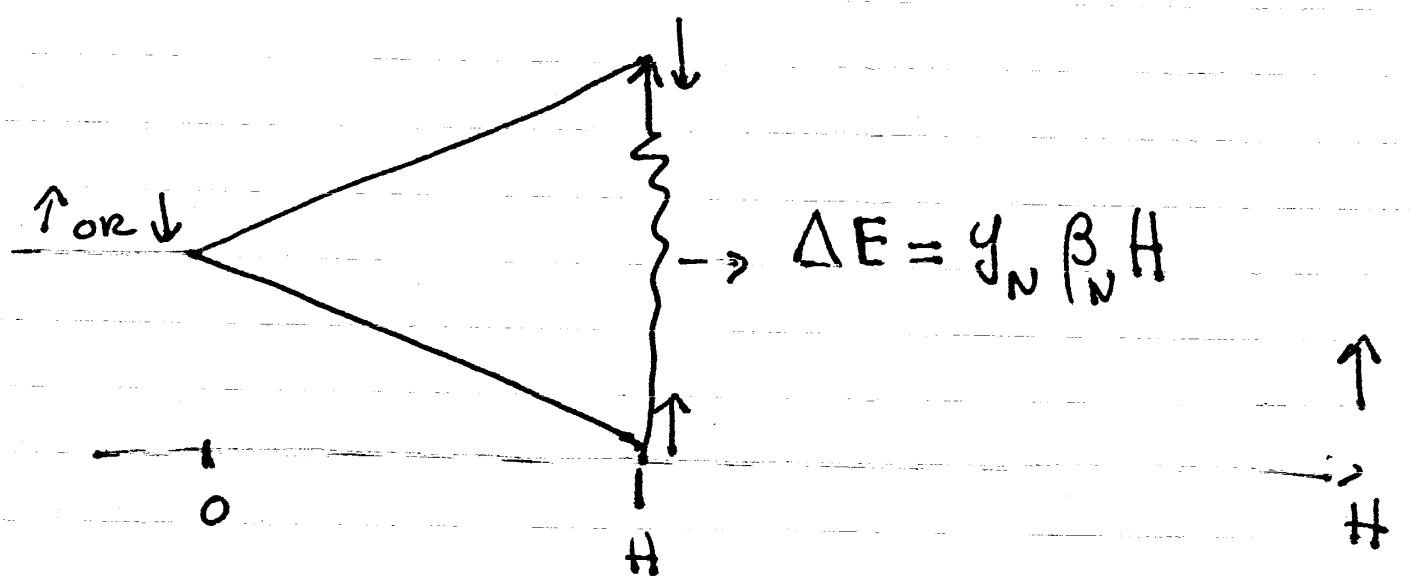


chemical shift

REFERENCE TMS (TriMethylSilane)

$$\delta \equiv \frac{H_s - H_{TMS}}{H_{TMS}} \times 10^6 \quad ppm$$

I — NUCLEAR SPIN



$\gamma_N \equiv$ NUCLEAR γ factor

$\beta_N \equiv$ NUCLEAR Magneton

EXTERNAL photon $h\nu_L = \gamma_N \beta_N H$

$$\nu_L = \frac{\gamma_N \beta_N}{h} H$$

For a proton in a field of 1T

$\nu_L = 42.576$ MHz (FM)

STANDARD TMS

Trimethylsilane

chemical shift for each proton is defined

$$\delta = \frac{H_S - H_{TMS}}{H_{TMS}} \times 10^6$$

ppm (part per million)

g_N NUCLEAR g-factor

β_N NUCLER magneton

$\Delta E = h\nu \rightsquigarrow$ FM radio frequency

BUT THE MAGNETIC FIELD IS LOCALLY MODIFIED BY THE PROTON'S ENVIRONMENT

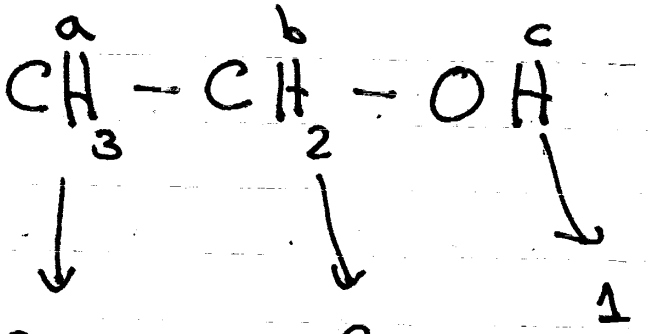
$$\nu_L = \frac{g_n \beta_N}{h} H_{loc}$$

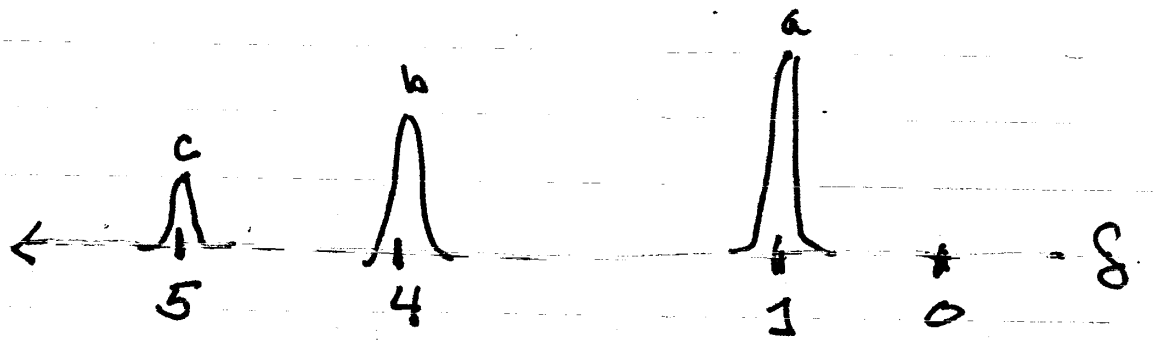
$$\delta = \frac{\nu - \nu_{TMS}}{\nu_{TMS}} \cdot x10^6$$ FIXED H.

$\delta = 0$ FOR TMS

$\delta \in [0, 12]$

NMR OF ETHANOL (Stanford U - 1951)





SPIN-SPIN COUPLING

$CH_3 - CH_2 - OH$

↳ 2 spins ⇒ n+1 teplet

a) FEELS A TRIPLET NEARBY

b) FEELS A QUADRUPLET

c) DUE TO THE PRESENCE OF THE O
H DOES NOT FEEL THE TRIPLET
(LOW H)