

# Spin-Spin Splitting in Proton NMR Spectroscopy

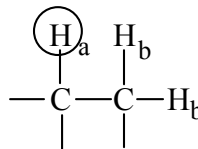
the doublet in  $^1\text{H}$  NMR



$B_0$  ↑↑

$H_a$  is coupled to  $H_b$   
 $H_b$  is parallel or anti-parallel to  $B_0$   
 $\therefore H_a$  splits into a 1:1 doublet peak

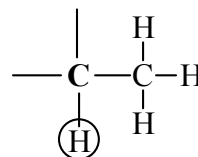
the triplet in  $^1\text{H}$  NMR



$B_0$  ↑↑ ↑↑ ↑↑

$H_a$  is coupled to  $H_b$  and  $H_b$   
 $H_b$  can both be parallel, anti-parallel  
 or one parallel and one anti-parallel  
 $\therefore H_a$  splits into a 1:2:1 triplet peak

the quartet in  $^1\text{H}$  NMR



$B_0$  ↑↑↑↑  
 deshielded

proton splits into  $n+1$   
 quartet 1:3:3:1  
 $n = \#$  adjacent H's

shielded

# Spin-Spin Splitting in C-13 NMR Spectroscopy

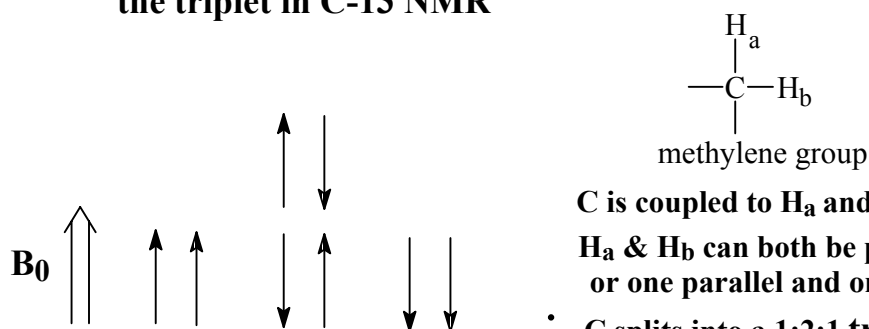
## the doublet in C-13 NMR



**C is coupled to H**  
**H is parallel or anti-parallel to  $B_0$**   
 **$\therefore$  C splits into a 1:1 doublet peak**

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## the triplet in C-13 NMR



**C is coupled to  $H_a$  and  $H_b$**   
 **$H_a$  &  $H_b$  can both be parallel, anti-parallel**  
**or one parallel and one anti-parallel**  
 **$\therefore$  C splits into a 1:2:1 triplet peak**

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## the quartet in C-13 NMR

