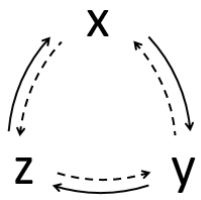
What Operators do

Pulse

$$I_z \xrightarrow{90°_x} -I_y$$
$$I_z \xrightarrow{90°_y} I_x$$
$$I_z \xrightarrow{90°_{-x}} I_y$$
$$I_z \xrightarrow{90°_{-y}} -I_x$$

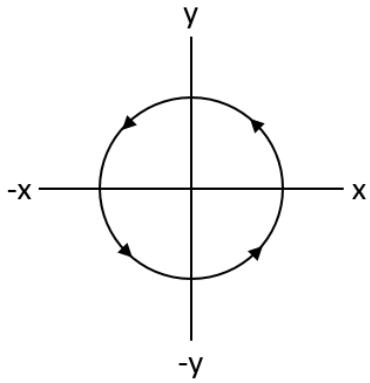


alphabetisch
= positives Vorzeichen (+)
„gegen“alphabetisch
= negatives Vorzeichen (-)

Puls → Ausgangsmagnetisierung → Endmagnetisierung

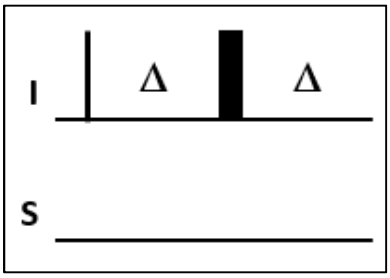
Chemische Verschiebung

$$I_x \xrightarrow{I_z\Omega\tau} I_x \cos(\Omega\tau) + I_y \sin(\Omega\tau)$$
$$I_y \xrightarrow{I_z\Omega\tau} I_y \cos(\Omega\tau) - I_x \sin(\Omega\tau)$$
$$-I_x \xrightarrow{I_z\Omega\tau} -I_x \cos(\Omega\tau) - I_y \sin(\Omega\tau)$$
$$-I_y \xrightarrow{I_z\Omega\tau} -I_y \cos(\Omega\tau) + I_x \sin(\Omega\tau)$$

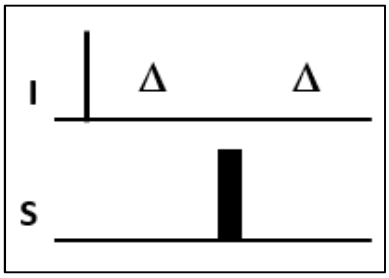


Skalare Kopplung

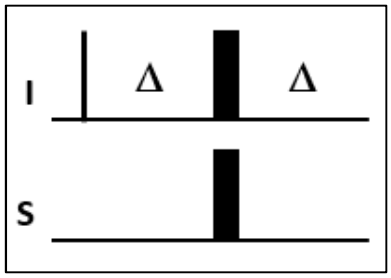
$$I_x \xrightarrow{2\pi J_{IS} I_z S_z \tau} I_x \cos(\pi J_{IS}\tau) + 2I_y S_z \sin(\pi J_{IS}\tau)$$
$$I_y \xrightarrow{2\pi J_{IS} I_z S_z \tau} I_y \cos(\pi J_{IS}\tau) - 2I_x S_z \sin(\pi J_{IS}\tau)$$
$$2\, I_x S_z \xrightarrow{2\pi J_{IS} I_z S_z \tau} 2I_x S_z \cos(\pi J_{IS}\tau) + I_y \sin(\pi J_{IS}\tau)$$
$$2I_y S_z \xrightarrow{2\pi J_{IS} I_z S_z \tau} 2I_y S_z \cos(\pi J_{IS}\tau) - I_x \sin(\pi J_{IS}\tau)$$



$\Omega_I : -$
$J_{II} : +$
$J_{IS} : -$



$\Omega_I : +$
$J_{II} : +$
$J_{IS} : -$



$\Omega_I : -$
$J_{II} : +$
$J_{IS} : +$

+ : Interaktion evolviert; − : Interaktion refokussiert