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Molecules probed with a slow chirped–pulse excitation: analytical model of the free–induction–decay signal

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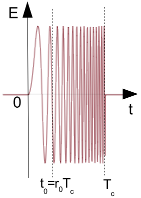
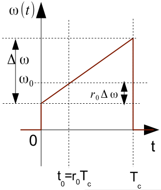
Linear chirped pulse : $\vec{E}=\vec{E}_0\sin(\omega(t).t)$

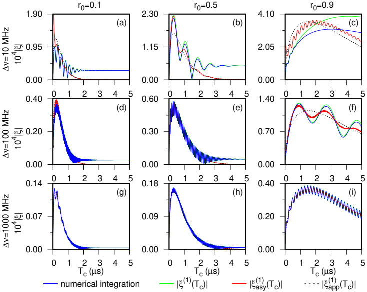




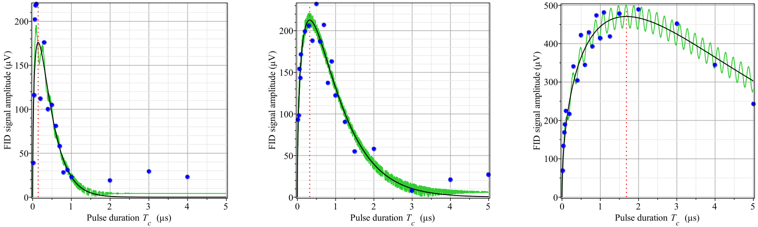
t	ω
0	$\omega_0-r_0\Delta\omega$
r_0T_c	ω_0
T_c	$\omega_0+(1-r_0)\Delta\omega$

$\omega=\omega_0-r_0\Delta\omega+\frac{\Delta\omega}{T_c}t$

β sweep speed of the CP: $\frac{d\omega}{dt}=\frac{\Delta\omega}{T_c}=\beta^2$



$$\left|\xi^{(1)}_{\rm app}(T_C)\right| = \sqrt{2\pi}\Omega_0\sqrt{\frac{T_C}{\Delta\omega}}\,e^{-\frac{T_C}{T_2}(1-r_0)}\left|W_{\rm eq}+(W_0-W_{\rm eq})\,e^{-\frac{T_C}{T_1}r_0}\right|.$$



We obtained an analytical approximation of the polarization at $t = T_C$ and of the free induction decay signal. The expressions are favorably tested against numerical integration and experimental data. The analytical expression of the FID signal can be used to optimize the S/R ratio or correct the intensities of the lines in a chirped pulse experiment.