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SIMPLE TWO-PULSE TIME-REVERSAL SEQUENCE FOR DIPOLAR AND QUADRUPOLAR-COUPLED SPIN SYSTEMS

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One of the interesting and practically important features of pulse NMR spectroscopy is the possibility to reverse time evolution of a spin system, resulting in evolution of the system from its state at $t>0$ to its state at time $t=0$. For the dipolar and quadrupolar-coupled spin systems, the attempts to change the sign of the interaction Hamiltonian were first carried out by Powles, Mansfield, Strange and Solomon [1]. Assuming that the applied *rf* pulses are delta $90^0_{X,Y}$ pulses, they have showed that the two–pulse sequence $90^0_Y - \tau - 90^0_X - Acq(t)$ yields the echo signal observed at $t = 2\tau$

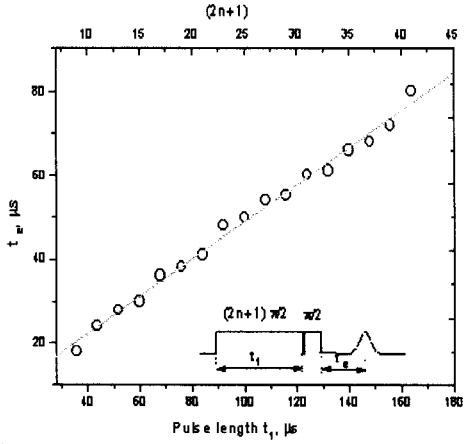

Fig. Dependence of the ^{7}Li echo signal position in $LiInSe_2$ after the second pulse t_e versus the length of the first pulse $t_1 = (2n+1)\cdot\pi/2$ for the pulse sequence $((2n+1)\cdot 90^0_Y - \tau - 90^0_X - Acq(t)$ $(\tau = 0.2\mu s)$. The pulse sequence is shown separately.

However, the formation of the solid and Solomon echoes contrasts to that of the Hahn echo [1], since the former echoes do not yield the inversion of the sign of the dipolar and quadrupolar Hamiltonians by *rf* pulses and can not be considered as the time–reversal experiments.

In this work, a general two-pulse technique $(2n+1)\cdot 90^{0}_{Y} - \tau - 90^{0}_{X} - Acq(t)$, which yields the inversion of the signs of dipolar and quadrupolar Hamiltonians and the reverse of the time evolutions of spin systems with dipolar and quadrupolar interactions, is presented.

[1] E.L. Hahn, *Phys.Rev.* **80,** (1950) 580; J.G.Powles, P.Mansfield, *Phys.Rev.Lett.* **2**, (1962) 58; J.G.Powles, J.H.Strange, *Proc.Phys.Soc.* **82**, (1963) 7; I.Solomon, *Phys.Rev.* **110** (1958) 61.