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Techniques and Systematic Effects of a Critically Dressed System

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Critical dressing, the simultaneous dressing of two spin species to the same effective Larmor frequency, is a technique that can, in principle, improve the sensitivity to small frequency shifts. The benefits of spin dressing and thus critical dressing are achieved at the expense of generating a large (relative to the holding field B_0,) homogeneous oscillating field. Due to inevitable imperfections of the fields generated and current supplied by the power supply, the benefits of spin dressing may be lost from the additional relaxation and noise generated by the dressing field imperfections. In this analysis the subject of relaxation, frequency shifts, and phase noise are approached with simulations and theory. Analytical predictions are made from a new quasi-quantum model that includes gradients in the holding field $B_0 = \omega_0/\gamma$ and dressing field $B_1 = \omega_1/\gamma$ where B_1 is oscillating at frequency ω, as well as noise generated by the power supply. It is found that irreversible DC gradient relaxation can be canceled by an AC spin dressing gradient in the Redfield regime. Furthermore, it is shown that there is no linear in E frequency shift generated by gradients in the dressing field. Critically dressed modulation techniques that extend the relaxation time by orders of magnitude are considered and application to tipping pulses are investigated.

Summary

While I recognize this is the summary field, I feel as though I have nothing to add.

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