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Shifts from distant neighboring levels in high-precision microwave spectroscopy of the $n = 2$ triplet helium fine structure A. MARSMAN, M. HORBATSCH, E.A. HESSELS, York University — In previous work, the systematic shifts of a resonance due to quantum interference from a distant neighboring resonance were derived for a closed four-level system [1]. Here we consider $n = 2$ triplet helium fine structure transitions in the microwave regime which are of interest for more accurate determinations of the fine-structure constant. The shifts are evaluated for both the Ramsey method of separated oscillatory fields (SOF) and for single microwave pulses driving the 2^3P intervals. The shifts are obtained by solving density matrix equations numerically, with the system initially prepared in the $2^3P_1, m_J = 0$ state and driven, e.g., near-resonantly to the $2^3P_2, m_J = 0$ state by 2.29-GHz microwaves. Despite being far off resonance, the $2^3P_0, m_J = 0$ state (which is 29.6 GHz away) has a non-zero excitation probability and interference from the spontaneous radiation from from the two states causes a small shift in the line center for the measured interval. The magnitude of such shifts are determined for measurements of both the 2.29-GHz and 29.6-GHz intervals. The SOF shifts are found to be considerably smaller than the single-pulse shifts.

[1] M. Horbatsch, E.A. Hessels, Phys. Rev. A 84, 032508 (2011)

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