Addendum to "Stimulated Electric Polarization and Photon Echoes"*

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The theory presented earlier demonstrates in a very simple fashion that regardless of the degree of saturation, the degree of degeneracy, or the displacement from line center, two circularly polarized pulses of opposite polarization will not produce a photon echo; and circular and linear polarization form very special canonical states of polarization.

Stimulating radiation which is circularly or linearly polarized will connect the $|m_a)$ and $|m_b)$ states of the upper and lower energy levels in independent pairs if the z axis is chosen as the direction of propagation for circularly polarized radiation or as the direction of polarization for linearly polarized radiation. States so connected can only contribute to an electric polarization which reradiates, in the propagation direction, a wave with polarization identical to that of the stimulating radiation. The operator $e^{\pm i\xi\tau}$ defined in an earlier paper,[1] as it represents the interaction with the stimulating radiation, similarly connects these pairs of states. For circularly polarized radiation, only diagonal matrix elements of this operator and matrix elements between states of $m_a - m_b$ equal to $+1$ for left- and -1 for right-circularly polarized radiation are nonzero. This implies that regardless of the degree of saturation, the degree of degeneracy, or the displacement of the stimulating frequency from line center, a left-circular–right-circular sequence of pulses propagating in the same direction can not produce a photon echo. The photon echo producing electric polarization expression [e.g., Eq. (31) of Ref. 1], contains $e^{\pm i\xi\tau}$ in such a way that this result follows.

The above was demonstrated for transitions involving $J \leq 2$ in Ref. 1. Dienes[2] has stated that two circularly polarized pulses of opposite polarization should not produce a photon echo. It is well known that two orthogonal linearly polarized pulses will produce an echo except for transitions involving a maximum J value of 1.[1,3] The above conclusions are apparent when $e^{\pm i\xi\tau}$ is expanded as a power series in ξ. ξ has matrix elements

$$(m_a|\xi|m_b) = \hbar^{-1}(m_a|V_0|m_b),$$
$$(m_b|\xi|m_a) = \hbar^{-1}(m_a|V_0|m_b)^*,$$
$$(m_a|\xi|m_a') = -\Delta(m_a)(m_a|m_a'),$$
$$(m_b|\xi|m_b') = -\Delta(m_b)(m_b|m_b'),$$

where $(n|n')$ is the Dirac delta, and $(m_a|V_0|m_b)$ is nonzero only if $m_a - m_b = +1$ or -1 for left- and right-circularly polarized radiation. For linear polarization $m_a - m_b = 0$. Elliptical states of polarization connect more than a pair of states, and the detailed analysis of Ref. 1 is necessary.

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[1] C. V. Heer and R. H. Kohl, Phys. Rev. A 1, 693 (1970).

[2] A. Dienes, IEEE J. Quant. Electron. QE-5, 246 (1969).

[3] J. P. Gordon, C. H. Wang, C. K. N. Patel, R. E. Slusher, and W. J. Tomlinson, Phys. Rev. 179, 294 (1969).

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Collision Spectroscopy. II. Inelastic Scattering of He^+ by Ne Dewitt Coffey, Jr., D. C. Lorents, and F. T. Smith [Phys. Rev. 187, 201 (1969)]. The data represented by the curves in Fig. 3 are of the same precision as those shown in Fig. 2; in order to make the data accessible to readers, the figure is reproduced here on a larger scale.

The printed version of Figs. 6(a) and 6(b) was incorrectly calibrated; the magnitudes in the ordinates should be reduced by a factor of $\frac{2}{3}$. Equa-