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One-beam coherent control effect at Si(111) surfaces: linear optical formalism and layer-by-layer analysis A.I. SHKREBTII, University of Ontario Institute of Technology, Oshawa, ON, Canada, J.E.N. ARZATE, J.L. CABELLOS, B. MENDOZA, Centro de Investigaciones en Optica, León, México, F. NASTOS, J.E. SIPE, Department of Physics, University of Toronto, Canada — We demonstrated how the so-called one-beam coherent control effect might be used as a complementary probe in surface physics to extract information about surface structure, electronic states, bonding, *etc.* In [1] this effect has been developed in terms of a *nonlinear* optical formalism. In contrast to [1], we presented a complementary ballistic photocurrent formalism that is *linear*. We demonstrated that the non-diagonal elements of the linear optical tensor contribute to this coherent control effect, which is due to the quantum interference between the two orthogonally polarized beams. Such ballistic photocurrent injection depends on the relative phase between these beams $(\phi_b$ - $\phi_c)$ as $dJ^{\,a}/dt = \eta^{\,abc}|E^b|\;\;|E^c|\;sin(\phi_b$ - $\phi_c)$. As the second step, we developed a microscopic formalism to *separate* the optical response produced by each atomic layer of a semi-infinite crystal. Finally, we applied this formalism to the clean Si(111) (2×1), Si(111):H (1×1) and Si(111):As(1×1) surfaces. The research was supported by NSERC Discovery Grant. [1] J.E. Sipe and A.I. Shkrebtii, Phys. Rev. B, **61**, 5337 (2000)

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