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**The Behavior of Electronic Interferometers in the Non-Linear Regime.** IZHAR NEDER, ERAN GINOSSAR, Department of Condensed Matter Physics, The Weizmann Institute of Science, Rehovot 76100, Israel — We investigate theoretically the behavior of the current oscillations in an electronic Mach-Zehnder interferometer (MZI) as a function of its source bias. Recently, The MZI interference visibility showed an unexplained lobe pattern behavior with a peculiar phase rigidity. Moreover, the effect did not depend on the MZI paths difference. We argue that these effects have a fundamental reason. A simple invariance argument leads to an additional interaction term that must be added to the non-interacting Hamiltonian. It causes correlations inside each of the two MZI arm, resulting in the electrons affecting each other's phase. An approximate solution shows that the interference visibility has a lobe pattern with applied bias with a period proportional to the average path length (and independent of the paths difference), together with a phase rigidity.

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