DAMOP07-2007-020068

Abstract for an Invited Paper
for the DAMOP07 Meeting of
the American Physical Society

Electron Matter Optics[1]

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Our group has realized a Mach-Zehnder interferometer for electron matter waves and a source of femtosecond electron pulses. In the first experiment a highly collimated electron beam passes through three gold coated nano-fabricated gratings and reveals interference fringes. Measured dephasing processes poses limitations on the low energy use of this device. In the second experiment a femtosecond laser pump-probe experiment on a field emission tip was performed. Control of the electron emission mechanisms, which are multi-photon absorption and optical field tunneling, may be useful for the production of attosecond electron pulses. We will discuss the use of the first device to test the dispersionless nature of the Aharonov-Bohm effect and the use of the second device to test the macroscopic limit of the Aharonov-Bohm effect.

[1]Supported by NSF.