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Electron pumping at gigahertz frequencies[1]

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Recently, we have overcome the upper frequency limit measured for earlier pumps, by removing the reliance on quantum mechanical tunnelling through barriers on either side of a quantum dot [1]. The ease of operation, high frequency and simplicity of the waveform driving the pump were unexpected findings, contrary to previous predictions. The high speed (GHz), accurate pumping of electrons at the nano-Amp current level allows for easy integration in a wide range of applications from the development of the current standard in the field of metrology to single photon production and quantum based computing, making these new findings of value to many scientific disciplines. The inclusion of a perpendicular magnetic field [2] has shown a marked improvement in the accuracy of the pumped current and allows the study of the interactions of controlled dynamic electrons with a magnet field. Recent work combining two electron pumps in parallel [3] has demonstrated an increase in current output without the increase in error associated with a higher output current from a single pump. With the control and manipulation of a selected number of electrons there is the possibility of the creation of a two-particle entangled state. An interference-type experiment with the inclusion of a beam splitter could be used to probe this state.

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