Abstract Submitted
for the NES21 Meeting of
The American Physical Society

Quantum Mechanics: Electrons, Transistors, and LASERS PAUL CARR, Air Force Research Lab - Hanscom Emeritus — Quantum Mechanical (QM) principles have enabled the invention of transistors and LASERS that impact our daily lives. Why have there been over 14 different interpretations of QM in the last century? "If you think you understand QM, you don't (Richard Feynman)." The 1947 invention of the transistor at the Bell Telephone Laboratory came from the QM theory of electrons in semiconductors. In 1954, Charles Townes, by inverting the population of electron quantum states, invented the MASER (Microwave Amplification of the Stimulated Emission of Radiation). The LASER was demonstrated in 1960. Both are based on the following equation: the energy difference between quantum states equals the Planck constant times the frequency of the radiation. A reason there are so many different interpretations of QM is that we are using macroscopic concepts and language to describe microscopic phenomena. In some experiments, electrons exhibit particle properties. In other cases, they exhibit wave properties: the wavelength being equal to the Planck constant divided by the electron momentum. Niels Bohr called particle-wave duality the Complementarity Principle. The Heisenberg uncertainty principle states the fundamental limit to the accuracy of QM measurements.

Paul Carr
Air Force Research Lab - Hanscom

Date submitted: 06 Apr 2021 Electronic form version 1.4