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Entropy change during measurements on a free particle in nonrelativistic and relativistic quantum mechanics. JUSTIN BRUTGER, ATHANASIOS PETRIDIS, GRACE DUNLEAVY, DANIEL DEETER, Drake University — The formulation of quantum mechanics is developed using the concept of information entropy. In the nonrelativistic case the quantum mechanical transition amplitude for a free particle is transformed via a Wick rotation of the time increment to obtain a partition function dependent on the time and space increments. This partition function is then used to find the entropy change of the system during a measurement. The requirement that this be real-valued leads to uncertainty-type relations, and the exhibition of positive information entropy exchange for small time intervals and negative entropy for large ones. The quantum mechanical transition amplitude of a free particle in the relativistic case is found through a Fourier transform of the Klein-Gordon equation and is separated through Heaviside step functions into the timelike, spacelike, and lightlike cases. The same process is used to find the entropy change during a measurement of a relativistic free particle, and the results are compared to the nonrelativistic case through examining the nonrelativistic limit.

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