Quantum Uncertainty in Principle and Practice

Plank's Law

$$\rho(\nu, T) = \frac{8\pi h \nu^3}{c^3} \frac{1}{e^{h\nu/kT} - 1}$$

Heisenberg's Inequalities

(1) $\Delta p \Delta q \geq h$
(2) $\Delta E \Delta t \geq h$

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Comparative Uncertainties

1. Electron Velocity.

Since $p = mv$, Heisenberg's first inequality is equivalent to $\Delta v \Delta q \geq h/m$.
For Plank's constant, h, we obtain the value, $h = 6.26 \times 10^{-27}$ (in units gram x cm^2 per second).
Suppose we want to localize the position of an electron ($m = 10^{-27}$) with precision Δq of 10^{-8}cm (the ground-state size of the hydrogen atom); in this case, we can then calculate that the velocity imprecision will equal 1,000 miles per second.

2. Human Velocity.

Measuring the position of a person of average mass walking at an average rate of 3.5 miles per hour to the same degree of accuracy permitted by Heisenberg's first inequality, we can simultaneously measure that person's velocity to an accuracy of one billionth of a billionth of a mile per second.