Additional clarification of the uncertainty principle.

All physical objects are quanta. This means that we need to use the quantum approach to accurately describe the physical properties of every physical system. And this can be done only by solving the corresponding Schrodinger equation.

Due to the probabilistic nature of the laws of nature, not all physical quantities can be simultaneously exactly measured. For example, this is impossible for coordinates and momentum of a particle, in contrast to the kinetic energy and momentum. the derivation of the equation can be found in the lecture

So, how is looks like the criteria of this possibility? In quantum mechanics is proved that the value of two physical quantities can be measured simultaneously and exactly only if corresponding operators (operators associated with corresponding physical quantities) are commute. But what to do if operators are not commute? It is clear that the corresponding non-commuting quantities can still be measured. But if it can't be done exactly, can it be done with some accuracy? May be possible to evaluate the lower theoretical limit for the accuracy of such measurements?

Answer on this question gives uncertainty principle (the derivation of the equation can be found in the lecture).

$$\sqrt{(<(\Delta A)^2>)}\cdot\sqrt{(<(\Delta B)^2>)}\geqslant\frac{|<C>|}{2}$$

here $\sqrt{(<(\Delta A)^2>)}$ - standard deviation of measurable quantities A from its mean value and

$$[\hat{A},\hat{B}]=i\hat{C} \quad .$$

For coordinate x and x-projection of momentum operator PX $[\hat{x},\hat{p}_x]=i\hat{\hbar}$ this principle is:

$$\sqrt{(<(\Delta x)^2>)}\cdot\sqrt{(<(\Delta p_x)^2>)}\geqslant\frac{|<\hbar>|}{2}$$

or

$$\sqrt{(<(\Delta x)^2>)}\cdot\sqrt{(<(\Delta v_x)^2>)}\geqslant\frac{|<\hbar>|}{2m} \quad .$$

If the coordinate of a body with a mass of 100 kg is measured with an accuracy of 10^{-10}m (ultra high accuracy) the lower border of measurement accuracy for velocity is around 10^{-35} m. Only with such measurement accuracy can one see quantum fluctuations in velocity and coordinates. As you can see, this is impossible for objects with macroscopic masses, and instead of quantum mechanics, in this case, ordinary and simple equations from classical physics can be used. Object demonstrate classical behavior.