Heisenburg Uncertainty Principle

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When light is shined onto a particle, some of the light waves will be scattered by the particle. This scattering pattern can be used to determine the position of the particle.

If long wavelength light is used, the position can be found. But the position cannot be known any more accurately, than within a wavelength of that light (the distance between crest and crest). If it has a long wavelength, then there is a large area that the particle could be in (large Δx). The position is not known accurately, while the accuracy of the particles movement is high (small $\Delta(mv)$).

If short wavelength light is used, the position can be found more accurately due to the shorter wavelength of the light (the particle is in a smaller area). But the shorter wavelength light has more energy (higher frequency), which will adversely affect the velocity of the particle. So the accuracy of the movement is decreased (large $\Delta(mv)$), while the position is known accurately (small Δx).

Long Wavelength/ Low Frequency ↓↓↓↓

Short Wavelength/ High Frequency ↓↓↓↓