Quantum mechanics

$\rightarrow$ describes the behavior of light and of matter at an atomic scale

$\rightarrow$ it is completely different from what is known from classical physics

$\rightarrow$ the behavior is not directly observable
$\rightsquigarrow$ protons | neutrons | electrons | photons behave like waves and particles
$\rightsquigarrow$ they behave like neither $\rightsquigarrow$ or as particle waves

$\rightarrow$ the behavior is in many ways mysterious, can often not be understood even by experienced physisists

$\rightarrow$ the workings of the mystery cannot be explained
$\rightsquigarrow$ the story can only be told as it (presumably) is
$\rightsquigarrow$ one can only answer questions about the HOW but not about the WHY

Some fundamental Observations | Conclusions

$\rightarrow$ in quantum mechanics it cannot exactly be determined what one particle is doing | in which state it is
$\rightarrow$ quantum mechanics always works with
$\rightsquigarrow$ probability amplitudes Φ or probabilities $|\Phi|^2$ of events taking place | particles being in certain states
$\rightarrow$ probability amplitudes for two or more events | states add up as

$$\Phi \ = \ \Phi_1 \ + \ \Phi_2 \ + \ldots \ + \ \Phi_n$$

and for probabilities holds

$$P \ = \ |\Phi|^2 \ = \ |\Phi_1 \ + \ \Phi_2 \ + \ \ldots \ \Phi_n|^2$$

$\rightarrow$ if experiments are being conducted | observations are being made to find out which of two or more alternatives are taken, interference is lost and probabilities add up:

$$P \ = \ P_1 \ + \ P_2 \ + \ \ldots + \ P_n$$

$\rightarrow$ in quantum mechanics it is impossible to talk about anything but but probabilities (or probability amplitudes)
$\rightsquigarrow$ the odds of how nature behaves at the level of elementary particles | not what is actually going to happen
$\rightsquigarrow$ there are no internal mechanisms which nothing is known about
$\rightarrow$ Heissenberg's uncertainty principle as the fundamental law of quantum mechanics

$$\Delta p * \Delta q \ = \ h \ = 6.63 * 10^{-34} \, Wattsec$$