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**Learning to Learn: The Art of Doing Science
and Engineering, Session 27:**

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Richard W. Hamming



Learning to Learn

The Art of Doing Science and Engineering

Session 24: Quantum Mechanics

Can we understand everything?



“... in all of the science there are only descriptions of how things happen and nothing about why they happen.”

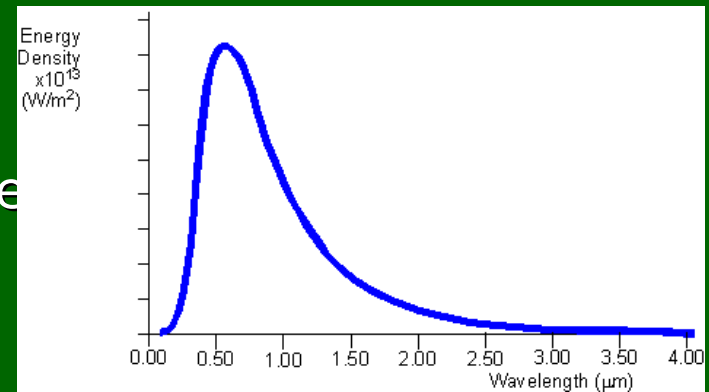
Can we understand everything?



Max Planck - Black body radiation

Experimental data fitted with empirical curve

Planck created new theory because approximating curve fitted well and had the proper form



The proof of correctness:

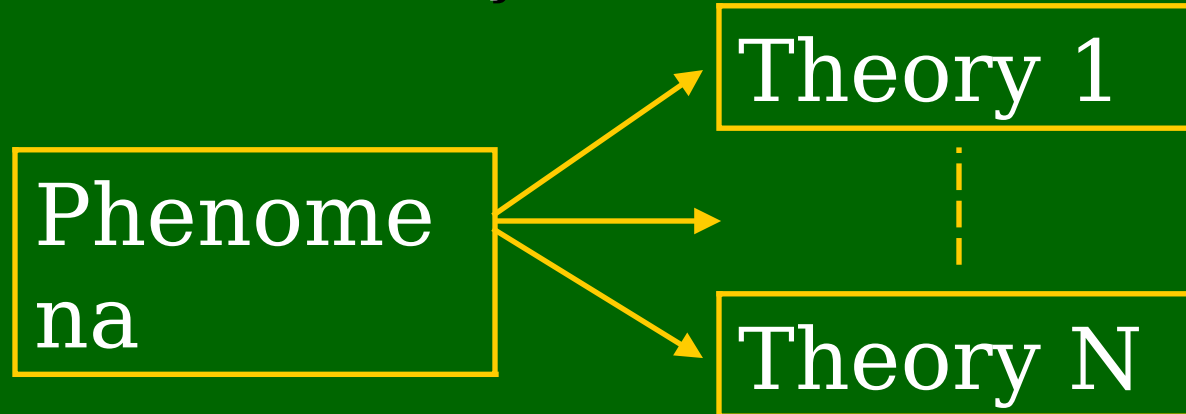
Einstein - Photoelectric effect
Bohr - Atomic model

The problem should be represented in terms of functions which are proper for the field.

Can we understand everything?



There need not to be a unique form of a theory to account for a body of observations

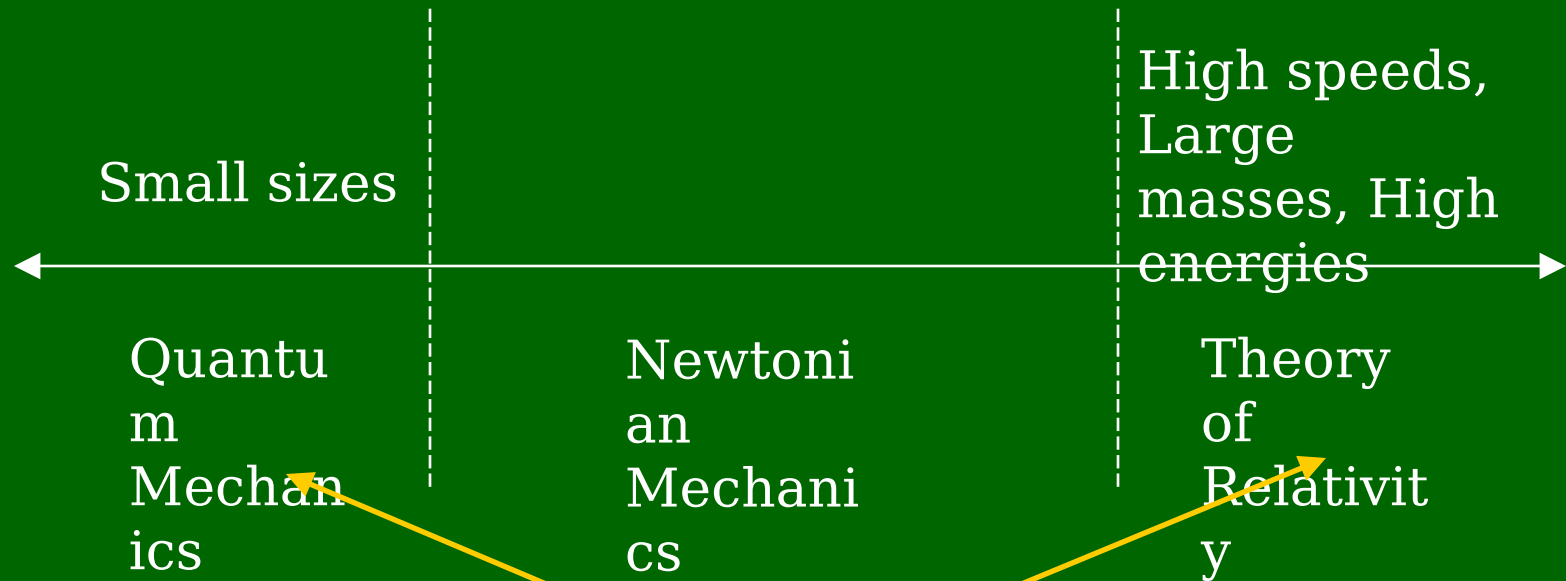


Both quantum-mechanic theories are equivalent:

- **Heisenberg - Uncertainty Relations**
- **Schrödinger - Wave equation**

You cannot go from a body of data to a unique theory.

Can we understand everything?



Are Quantum Mechanics or Theory of Relativity thoughts our brain cannot think?

Example:

Wave-particle duality – “I cannot explain this, you will get used to it”.

Can we understand everything?



Probabilistic base of Quantum Mechanics:

The square of the Schrödinger wave function is to be interpreted as a probability of observing something.

- **Is there anything below it ?**

Perfectly definite structure vs. No lower structure

- **Do we have free will?**

If there is no free will why do we believe in God's punishment, justice or mercy?

- **Do we know everything?**

Democritus - "All is atoms and void." If it is true, how interact psychical and physical world together?

Can we understand everything?



If non-local effects in quantum mechanics exist how can we explain immediate effect, which contradicts both the special and general theories of relativity?

If we understand something, can we explain the meaning of “understand”?