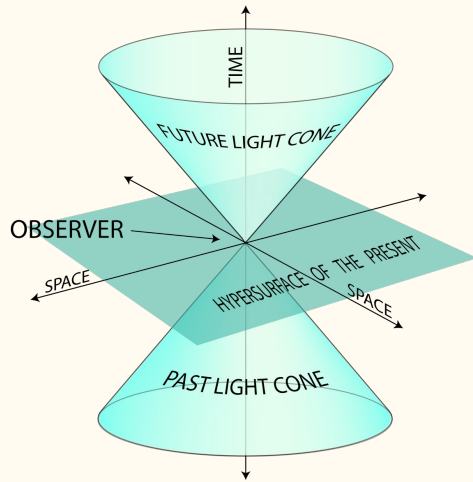


# INTERACTING ELECTRON-PHOTON SYSTEM IN ONE SPACE DIMENSION

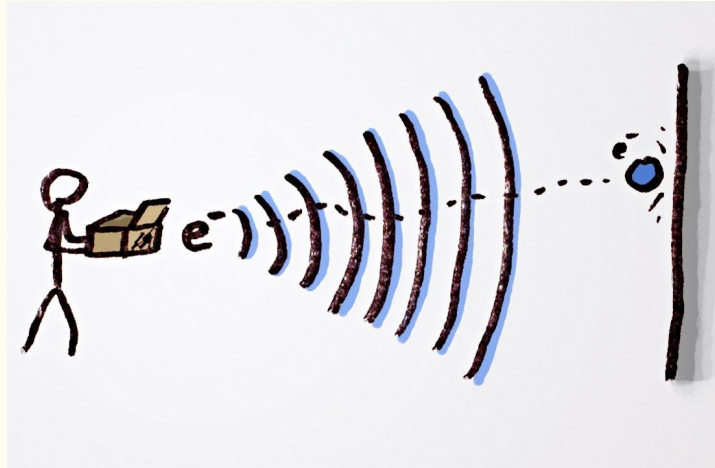


PROF. SHADI TAHVLIDAR-ZADEH  
XIANGYUE WANG  
ADRIANA SCANTEIANU

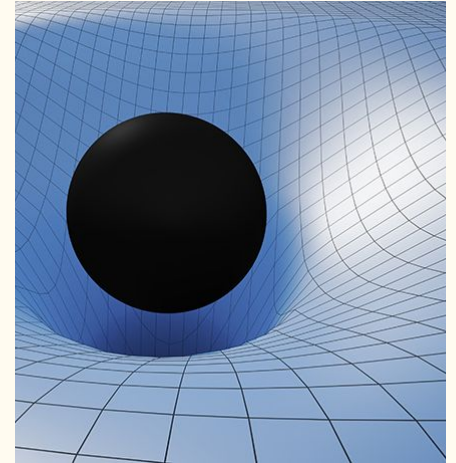
# Special Relativity + Quantum Mechanics



Special Relativity



Quantum Mechanics



(Gravity?)

The question we want to answer is the following:

---

The question we want to answer is the following:

**CAN WE COME UP WITH A  
PICTURE OF ONE DIMENSION  
PHOTON-ELECTRON COLLISION**

---

The question we want to answer is the following:

**THAT IS BOTH REALISTIC AND  
MATHEMATICALLY  
RIGOROUS?**

In 1923, by observing how an X-ray scattered off graphite, Arthur Compton confirmed Einstein's discovery that



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light behaves like...



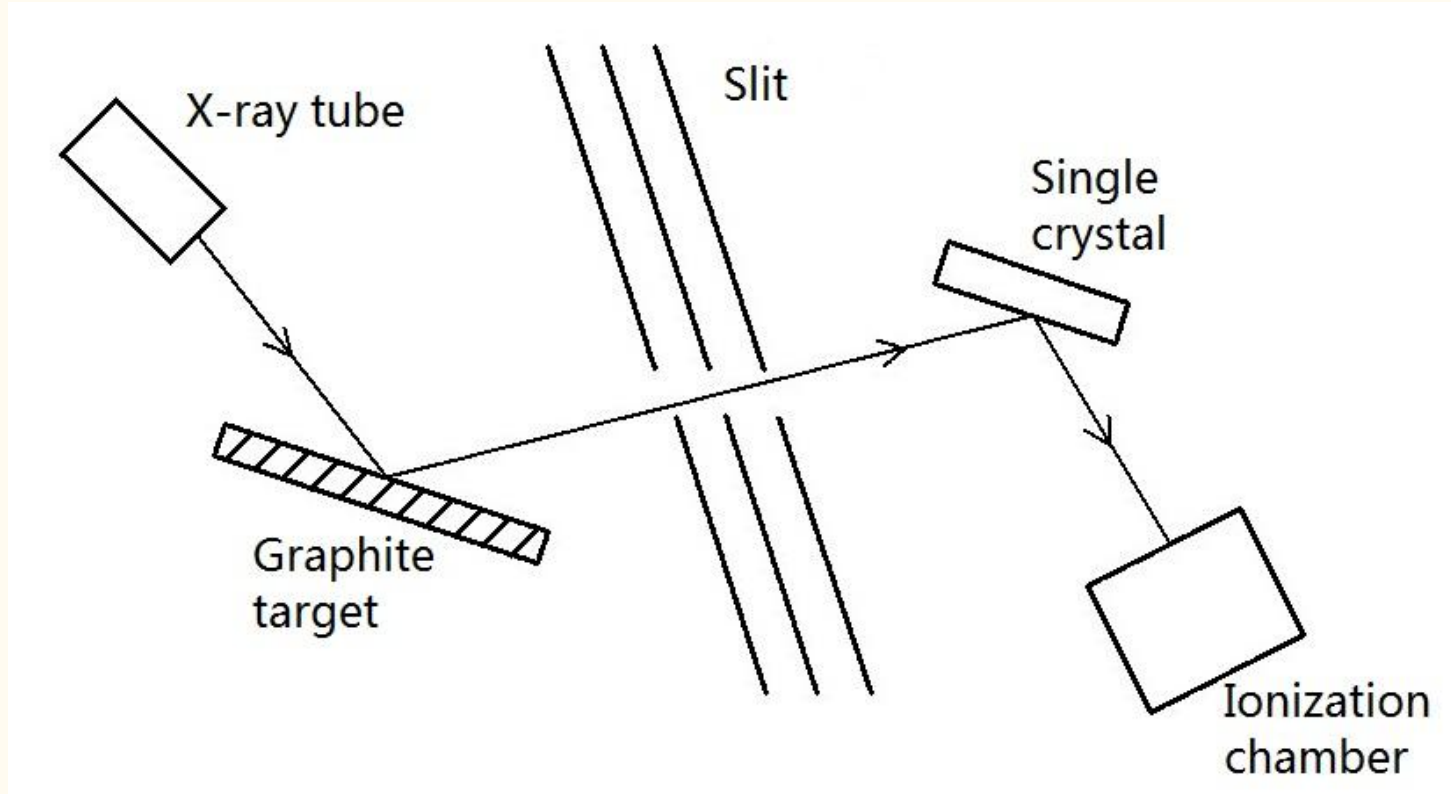
...a stream of particles.



This is how he found out:

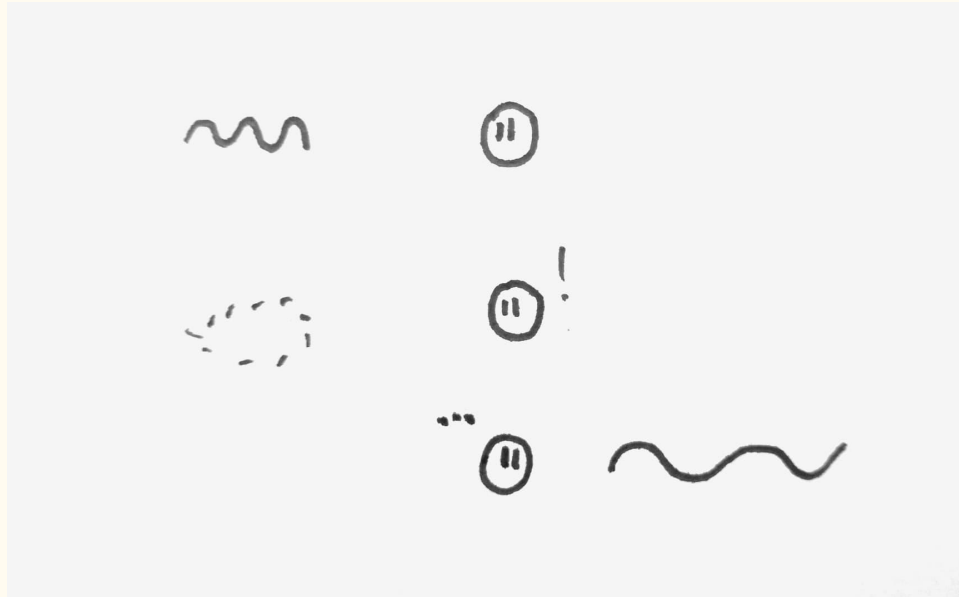


This is how he found out:



The picture Quantum Field Theory gives is the following:

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But not all physicists agree.

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“...the Compton effect, at its discovery, was regarded as a simple collision of two bodies, and yet the detailed discussion at the present time involves the idea of the annihilation of one photon and the simultaneous creation of one among an infinity of other possible ones. We would like to be able to treat the effect as a two-body problem, with the scattered photon regarded as the same individual as the incident, in just the way we treat of the collisions of electrons.”

--C. G. Darwin *Notes on the Theory of Radiation*



Charles Galton Darwin  
1887 - 1962



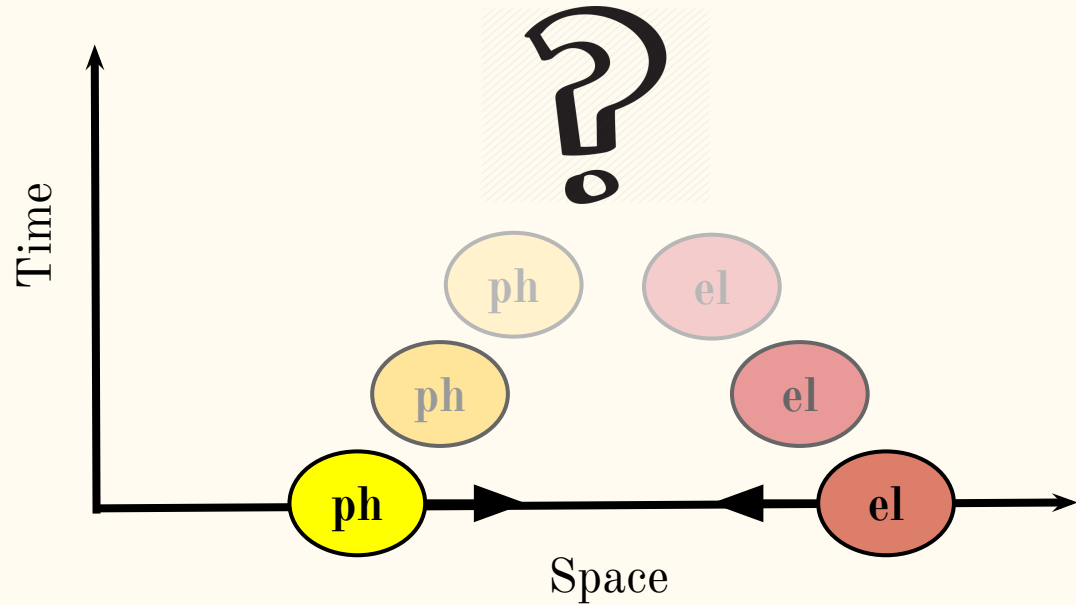
In short, we want to treat both electron and photon as quantum particles, their motion guided by a wave function defined on the 2-particle configuration space.

In other words, a description using relativistic Bohmian Mechanics.

# A Quick Note on Bohmian Mechanics



# 1 Space Dim, 1 Time Dim, 1 Wave Function



Using Matlab, we will simulate the collision of photon and electron using a 2-particle relativistic multi-time wave equation, in one space dimension.

We hope this will bring us one step closer to understanding photon-electron interactions in a more realistic system.

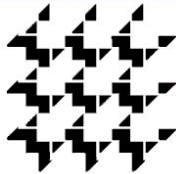
Thank you to Professor Tahvildar-Zadeh and his work with Professor Kiessling.

Work supported by the Rutgers Department of Mathematics.

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Founded as a National Science Foundation Science and  
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