E. F. Deveney / BSC Physics: PH402 Physics timeline ≥1900

Note Title 1/22/2006

From These 3 Key refs

① * Sci Amer Feb, 2001, wheeler pg68-75

② * PT, Dec 1976 pg 23-27

③ Ref: AJP 73(11) 999-1008 (2005)

1) Classical Newtonian Mechanics
2) Maxwell's Equations
3) Maxwell-Boltzman - stat mech ---- getting classical mechanics from 10^{23} particles

particles = particles
Light = waves

1900

BB radiation
ultraviolet catastrophy — Planck's Quantization! h

1905 photo-elect → Einstein's Light Quantization

Light = waves + particles

1900 Max Born @ U. Gottingen Germany (was scribe for Goteschalk)

David Hilbert "greatest mathematician of 20th century"

Also Hung with Klein (later Klotz Klein)

& Minkowski → died 44 ruptured append

said "physics is too hard for physicists"

1905 ⇒ Special Relativity

A. Einstein

time

e⁻'s = particles + waves!

1912 Bohr Model of Atom

L=nh --- orbital

get all discrete Spectroscopic Experimental results

* But, no real mechanism or deeper understanding of standing waves & so on. So Big ?s

call it old Quantum Theory.

1916 ⇒ A. Einstein General relativity

Quiet until 1921

In any case, BORN, & intellectual center of world & Primed for Break thru!

1921

Born @ Göttingen → prof has 2 student assistants
1) Wolfgang Paoli
2) Werner Heisenberg ⇒ on loan from Summerfeld who was lecturing in U.S.
↑ Big rep as smart

1925 ⇒ Heisenberg a stew in Copenhagen to understand old Quantum Theory returns to Göttingen gets Hay Fever attack so retreats to resort island = Helgoland in North Sea sea relief. Returns to Gött & has beginnings of Q.M.

According to AJP Author, Heis, is one who took the HUGE Step from Bohr Atom to Quantum Theory!

Sept 1925 paper: On a quantum-theoretical interpretation of kinematic and mechanical relations
Tough to read, lots of assumptions!

Heisenberg

gives paper to Born.
Born, physically & mentally tired -- gives it to his student Pascal Jordan (Brilliant)
↓
They see Messy math @ linear algebra & matrix mechanics!
publish in 1925
Acknowledges Heisenbergs HUGE Step: This paper is essence of matrix mechanics

Dirac sees Heisenberg talk
↓
w/o knowledge of Born-Jordan
↓
recognizes too that all Heisenberg's fancy work is Matrix mechanics

1925 Heisenburg ← 1912 Bohr atom → 1924 – de Broglie (French) 1929 Nob Prize $\lambda = h/p$

Born – Jordan

Dirac

1925 matrix mech.

Dirac: Matrix 1926 Mech w/ no mention of B-5

1925: Austrian Schrö talking about de Broglie in Zurich. When done, Peter Debye asked, "you speak of λ, what is the wave equation"

1926 Schrödinger

See: Phys Today Dec, 1977 pg 23

Sci Amer, Feb, 2001 pg 68

Also See Veltman, Facts & Mysteries of Q.M.

2-Quant Mech

Matrix ⇔ Wave

Some people like wave equat = physical

Heisenburg didn't like wave because it was physical

Al. Einstein liked wave.

1926 ⇒ Schrö shows matrix mech = wave mechanics (But what is Ψ?)

1926

Max Born gets Copehagen interp of Q.M. Ψ = prob Amplitude!

1928. Al Einstein nominates Heis, Born, Jordan for Nob. Prize. too speculative @ time

1928: Dirac Equat

1929 de Broglie N. Prize

1932 Heisenburg Nob Prize!

1933 Jordan Nazis? didn't sit well w/ anyone!

1933 Dirac + Schrö ⇒ Nob. prize

Big Controversy?
what about Born-Jordan
Bad Feelings

1935 ⇒ EPR

1948 = QED & Renormalization
Feynman
Schwinger
got ⇒ To

1945 nuc Bomb
1947 transistor

1954 ⇒ Yang-Mills
Guage Theory

1954 Born Nobel Prize Alone
No Jordan
for prob Amplitude =
prob interpret of Q.M.

1963 Feynman, Schwinger
took Nobel Prize
QED

1960 → LASER invented

1964 John Bell: EPR
No Local Hidden
variables
is: Bell's Inequality

1973 Electroweak
unification!
(8), W^-, W^+, Z^0
predicted

1975 Tau lepton

1982 Alain Aspect:
Bell's Inequality
Einstein wrong
Spooky Action
is here! Quantum
Right!

1983 Discovery of Z^0

1987 High Temp Superconductivity

1995 Discovery of Top Quark

1993 Quantum Teleportation
Theory

1995 BECs

2000 Hint of Higgs

My Thesis! →

My CERN work →

My PRL w/ Dave →

Next?

Susy

Decoherence

Grand Unification

TOE