



New Physics of the Electron

Changing the Charge State

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The Trouble with Physics (by Lee Smolin)

- **The quandary in which physics finds itself -- “we have failed. ...**
 For more than two centuries, until the present period, our understanding of the laws of nature expanded rapidly. But today, despite our best efforts, **what we know for certain about these laws is no more than what we knew back in the 1970s.** ... Since at least the late eighteenth century, significant progress has been made on crucial questions every quarter century.” [Introduction]
- **Usually a situation like this indicates a mistake may have been made in the past – that some basic physical assumption may be wrong.**
- **The nature of the charge of the electron is just such a physical assumption that needs to be re-examined**

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The Discovery of the Positive Electron (Positron) -- A Different Interpretation

What if the Dirac Equation with its negative energy interpretation did not exist?

What would the discovery of the positive electron imply?

- Either we would assume
 - it to be a separate distinct entity
 - or **that the sign of the charge (charge state) of an electron is not a fixed property but can be changed under conditions to be determined.**
- Recent unusual discoveries may support the latter view (heat flow along a quantum Hall edge; Fractional Quantum Hall Effect (FQHE); High Temp. Superconductivity; anomalous heat generation in electrochemical cells; etc.)

The influence of the Dirac equation may have misled physics since the early 1930's

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Evidence for Electrons becoming Positrons?

- **Heat Flow along a Quantum Hall Edge** (Harvard University Physics Department) – saw heat transport both in the downstream direction (due to electrons) and the upstream direction (due to a positive entity?)*
- Saw no evidence of any upstream charge transport – used “neutral modes” to explain the heat transport.
- A simpler explanation is that positrons are being formed under the specific conditions for Fractional Quantum Hall states
- If positrons are forming, trying to detect them will prove impossible due to electron-positron annihilation reaction (emitting two detectable gamma rays – its signature if taking place)

*V. Venkatachalam, "Single Electron Probes of Fractional Quantum Hall States," Ph.D. Thesis, Harvard University, 2012.

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Physic Phenomena possibly related to Positron Formation

- Fractional Quantum Hall Effect (FQHE)
- High Temperature Superconductivity
- Electrochemically Generated Excess Energy

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Fractional Quantum Hall Effect (FQHE)

- Experimental Conditions
 - Electrons confined to 2-dimensions
 - Temperature near absolute zero
 - Strong magnetic field perpendicular to electron plane
- Theory
 - Fractionally charged quasiparticles (composite fermions)
 - SIMPLER Approach – possibly a fraction of the electrons have become positively charged
 - this would imply the gamma ray signature of annihilation should be present (a good, but not necessarily easy, test)

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High Temperature Superconductivity

- Generally tend to be layered structures
- Still no theory after 33 years
- Perhaps a new property for the electron could help
 - If the electron's charge state can be altered, this could help to explain how it could traverse the electric fields present in the layered structures without loss (charge coupling and oscillation)

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Electrochemically Generated Excess Heat

- There have been enough successful experiments to establish the phenomenon
- The cause remains uncertain
 - The claim of “cold fusion” or low energy nuclear reactions (LENR) remains controversial and has marginalized this real effect
 - Could annihilation (due to some of the electrons becoming positively charged) be an alternate explanation?

Electron-Positron annihilation might not be less controversial, but a much more plausible explanation

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Proof that Positrons are Formed

Electron-Positron annihilation

The presence of two .511 MeV gamma rays (in opposite directions) or a 1.02 MeV gamma ray would support an annihilation mechanism

This measurement needs to be done

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Summary

- **Discovery of the positive electron (1932)**
 - Alternate implication is that the charge state of the electron may be able to be changed (**a new electron behavior to exploit**)
- **Charge State Change -- Under What Conditions?**
 - Based on the three phenomena above
 - Constrain the electron's motion to 1 or 2 dimensions
 - Apply an Electric or Magnetic field of sufficient strength to flip the electron's charge state
- **Electron-Positron gamma ray annihilation Signature**
 - Needed to establish the validity for this new electron property

Refer to website www.GAP-s.net for more information

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APPENDIX

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Short History of the Electron

- **1897** Discovered by Thompson
- **1909** Charge determined by Millikan
 - The smallest unit of charge until the construct of the quark in the 1960's
- **1932** Positively charged electron discovered by Anderson (dubbed the “positron”)
 - The origin of the idea of antiparticles (mainly because of the Dirac equation with its negative energy solutions)

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The Ultimate Green Energy Source

The Solution

Particle –Antiparticle Annihilation

100% Mass to Energy Conversion

(specifically looking at electron – positive electron (positron) interaction)

No radioactivity (or transmutation) and no CO₂ emitted

The Problem

A viable (inexpensive) source of positive electrons

(as well as the efficient use of the gamma rays emitted in the process)

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Known Sources for Positrons

- **High Energy Particle Collisions**
 - Cosmic Rays – led to the discovery of the positive electron (Anderson, 1932)
 - Accelerators
- **β^+ decay of radioactive isotopes (²²Na)**
- **High Power Laser Interactions with Materials**
 - Gold target – recent work produced record quantities

None of these are a viable inexpensive solution

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Implications for a Viable Source of Positrons (altering the charge of the electron)

- Energy source (cheap limitless green energy)
- Replacement for the Battery
- Makes Desalination feasible
- Ends our reliance on nuclear reactors (solves nuclear proliferation)
- Eliminates our electrical grid with its vulnerability
- May solve the matter-antimatter “imbalance”

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Neutral Electron?

- Many particles discovered have been seen to exist in three charge states
 - negative, neutral & positive (the mass of the neutral particle is generally smaller)
 - **Is there a neutral electron?**
 - Could this be the neutrino?
 - Pauli wrote in his famous 1930 letter “The mass of the neutron [neutrino] must be of the same order of magnitude as the electron ...”
 - Present estimates put the mass much less than that of the electron – This raises the intriguing question
- Is there energy (mass) associated with charge?**

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Halpern & Thirring 1931

The Elements of the New Quantum Mechanics (London, 1930-1931)

"Dirac's system of equations refers to particles of charge $+e$ as well as to those of charge $-e$; ... this signifies that according to Dirac's theory the electrons can change their sign. ...

In practice, therefore, until these difficulties are removed we shall merely retain one-half of the solutions which correspond to positive mass and subject them to comparison with experiment."

P 150 The Concept of the Positron by N. R. Hanson Cambridge Univ Press 1963

"In the quantum theory, since in general a perturbation will cause transitions from states with E positive to states with E negative, such transitions would appear experimentally as the electron (whose charge) suddenly changes from $-e$ to $+e$, a phenomenon which has not been observed." Dirac (1928)

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