

Re: Loop quantum gravity – loop quantum electrodynamics

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From: Tom Roberts (tjroberts_at_lucent.com)

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francoisbelfort@yahoo.fr wrote:

- > *Has anybody managed to tell the story of classical electrodynamics*
- > *– on the same level as Jackson – with loops?*

Yes. In several different but equivalent ways.

Kaluza–Klein theory posits a 5–d spacetime in which one dimension has the topology of a circle and is unmeasurably small. An appropriate GR–like theory on such a manifold yields GR + classical electrodynamics.

QED is a gauge theory of electrodynamics with gauge group $U(1)$, which is isomorphic to rotations around the unit circle. The modern interpretation of this is as a fiber bundle with fiber $U(1)$, which essentially assigns a "tiny circle" to each point of spacetime.

- > *How would*
- > *electrodynamic loops describe the scalar and vector potential?*
- > *The E and B field? Or a light beam?*

In QED the position on the loop represents a quantum mechanical phase. The selected representation of $U(1)$ represents a particle's charge (naturally quantized as a product of a unit charge times any integer). The phenomena we interpret as E and B fields, radiation, etc., come about through quantum interference.

- > *Are there any references?*

Google is your friend. For an excellent, nonmathematical introduction to QED this book cannot be beat: Feynman, *_QED_*.

Tom Roberts tjroberts@lucent.com