Topological Interpretation of E&M

The goal of topological research into electromagnetic fields is to discern whether they can be obtained from the structure of spacetime manifolds. This can come from either from its geometrical structure, like the gravity, its topological structure, or some combination of both.

“Einstein, in particular, felt that the unification of electromagnetism and gravitation would probably be closely related to two other longstanding problems: the causal interpretation of wave mechanics and the extension of electromagnetism to a nonlinear theory” (Delphenich).

This interests me because the introduction of the methods of differential geometry into physics started with general relativity originated due to Einstein’s consideration of the sub-manifolds for the wave equation that followed as a special case of Maxwell’s equations for electromagnetism. I think it would follow to attempt to introduce spacetime into the E&M

The research of topological basis of E&M goes into geometrical and topological nature of constitutive laws, and the existence of wavelike solutions.

Current research suggests “torsion may serve as a source for electromagnetism and electromagnetism may serve as a source for torsion. Unlike most couplings, this gives rise to conservation of charge, no magnetic monopoles, and is in agreement with the principle of equivalence” (Hammond). This may bring the Topological interpretations of E&M closer to a unified theory.

Sources:

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