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Modified Villain formulation of axion-Maxwell theory and generalised symmetries.

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Abstract: Recently, there has been a dramatic shift in our understanding of the notion of symmetry in a quantum field theory. Lattice gauge theory provides one of the best non-perturbative approaches to understanding QCD. This motivates the need to understand the recent generalised symmetries in the context of lattice gauge theory. In this talk I will use the lattice description of axion-Maxwell theory as a toy model to explore these ideas. This model exhibits a rich symmetry structure, including higher group, as well as non invertible symmetries. I will comment on how such structures are manifested in the lattice regularisation and comment on application to non-abelian generalisations.

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