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Equivalence and Classification of 4D Adinkras (student talk)

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Adinkras are powerful and concise tools for the representation of complex supersymmetrical algebras as graphical objects. As these graphs can be seen as topologically equivalent to hypercubes of varying dimensions then these objects can be studied in terms of their underlying matrix structure. We have discovered a means of classifying all 4D Adinkra graphs in terms of attributes of their colour-sign superimposition matrices. Our efforts culminate in research towards the construction of a simple object for computing Adinkras using a minimum number of these matrix attributes. This result leads to a prediction of all possible solutions of topologies, with our focus upon the Chiral Supermultiplet.

Summary

Adinkras are a simple means of preserving supersymmetric algebraic and differential relationships between physically significant field theories and measurable operators. These graphs obey simple rules of composition, namely they are odd-dashed bipartite representations.

These representations encode pertinent information pertaining to the super-partner relationships between the two fundamental forms of physical matter: bosons and fermions. All graphs begin with a bosonic node, which depending upon the specific energy level will produce some connected fabric of further boson-fermion super-partner networks.

The three principle cases of Adinkra representation come from the Chiral, Vectorial, and Tensorial supermultiplets. These result in three distinct Adinkra topologies that can be represented in terms of a set of adjacency matrices, corresponding to each of the colour-coded edges given in the graphical representation.

Each of these representations encodes specific properties and attributes of the underlying adjacency matrices, as well as important physical information concerning available energy levels.

While Dr. Sylvester James Gates et al (**S.J. Gates, Jr., T. Grover, M.D. Miller-Dickson, B.A. Mondal, A. Oskoui, S. Regmi, E. Ross, and R. Shetty, A Lorentz
Covariant Holoraumy-Induced "Gadget"From Minimal Off-Shell 4D, N = 1 Supermultiplets, Arxiv 1508.07546, 2015**) have developed a "gadget" tool which allows for some dimensional and topological analysis of Adinkras, the specific behaviour of this object remains somewhat elusive and it is unknown as to exactly what its ramifications are. Motivated by categorical and topological equivalences we have sought to construct a new "gadget" which enables one to compute equivalent classes of Adinkra topologies.

Using the elementary properties of the adjacency matrices it is possible to encode the geometric striation of each super-adjacency matrix into a nine-digit identifier. This "Gadget" can further be compressed into a five-digit serial number, via a change of numerical base, which permits one to generate equivalence classes of Adinkra representations.

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