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Subchromatic Tensor Models

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In addition to well-known adjoint/matrix model and vector model large N limits, a new large N limit dominated by melonic diagrams has attracted a great deal of attention recently. The melonic limit was first observed in tensor models, but interest in this limit grew due in large part to its appearance in the SYK model. While there are important dynamical differences between the SYK model and tensor models, tensor models provide a very natural context for understanding the diagrammatics of the melonic large N limit, and its possible generalizations.

Here we seek to better understand the entire range of models for which melonic diagrams dominate. We study tensor models constructed out of fields that are rank-r tensors with order-q interaction vertices. We define subchromatic tensor models to be those for which $r < q - 1$. We focus most of our attention on sextic ($q = 6$) models with maximally-single-trace interactions. We show that only a handful of subchromatic sextic maximally-single-trace interaction vertices exist. For each interaction we demonstrate that the set of Feynman diagrams that contribute to the free energy in the large N limit are melonic (or closely related to melonic diagrams) and thus can be explicitly summed.