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Research Proposal

Job Number: **W22219**

Proposal Abstract In all generality, my goal is to improve hadronic models better fit hadron spectra and to improve theoretical predictions of multi nucleon objects. My proposed method of attack is with holographic models. These models have the mysterious fifth dimension, but such a dimension is the geometric realization of the renormalization group (RG) flow of the theory from IR to the UV. The leading holographic model is holographic Sakai-Witten-Sugimoto model that is a bottom-up model with type IIA string theory. The strongly coupled hadron physics is said to be dual to weakly coupled supergravity theory. The model uses topological soliton in the bulk to model baryons (skymions) in the boundary with confinement and broken chiral symmetry. I propose to two topics of research: further understanding of the moduli space for the self-dual instatons/dual to skrymion. I propose two research topics. Extend the moduli analysis currently being done. The instatons in flat space represent the transitions of QCD vaccua. In the hologrpahic, negativly curved space case, the instatons are dual to skymions, so the moduli of such holographic solitons are dual to the baryons. Because the holographic solitons are topological, within the Sakai-Witten-Sugimoto number of baryons is a topological invariant. Further, analysis of the moduli spce can determine where it is a Riemannian manifold or not. Similar to the flat space case, such understanding of the moduli can help construct multi baryon solutions quantized degress of freedom. The other proposed line of research would involve modeling (high) spin hydronic spin states with a scalar theory. Within holographic theories, one can introduce two-component complex scalars such that they have a broken chiral symmetry. It is hypothesised that the broken chiral creates non-topological domains walls. It was novel to test the effectiveness of such a model to model confinement and it's effectiveness to model low mass hadron states.

I believe that my research topic and work would most closely aglign with Dr. Masaaki Kimura and his group at the Nucleon Many-body Theory laboratory. **ADD MORE HERE**

I would expect a year to find interestingly novel results. **ADD MORE HERE**

Proposed Method of Research **ADD MORE HERE**

Expected Results **ADD MORE HERE**

Future Work **ADD MORE HERE**