Contribution ID: **48** Type: **Parallel Sessions**

Finite Energy One-half Monopole Solutions of the SU(2) Yang-Mills-Higgs Theory.

Thursday, July 5, 2012 2:55 PM (15 minutes)

We would like to show the existence of finite energy SU(2) Yang-Mills-Higgs particles of one-half topological charge. The 't Hooft Abelian magnetic fields of these solutions at spatial infinity correspond to the magnetic field of a positive one-half magnetic monopole located at the origin, $r = 0$, and a semi-infinite Dirac string singularity located on one half of the z-axis which carries a magnetic flux of $\frac{2\pi}{g}$ going into the center of the sphere at infinity. Hence the net magnetic charge of the configuration is zero. The non-Abelian solutions possess gauge potentials that are singular at only one point, that is, on either the positive or the negative z-axis at large distances, elsewhere they are regular. There are two distinct different configurations of these particles with different total energies and energy distributions. The total energies of these one-half magnetic monopole solutions are calculated for various strength of the Higgs field self-coupling constant λ and they are found to increase logarithmically with λ. These solutions do not satisfy the first order Bogomol'nyi equations and are non-BPS solutions.

Summary

We have found four different types of one-half monopole charge solutions that we label as Type $A1$, $A2$, $B1$, and $B2$. The Type B ($B1$ and $B2$) solutions seem to be a 180^o rotation of the z-axis about the origin, $r = 0$, of the Type A ($A1$ and $A2$) solutions. However for a particular value of Higgs self-coupling constant, λ, the Type 1 ($A1$ and $B1$) and Type 2 ($A2$ and $B2$) solutions possess different total energies as well as energy densities distributions. They also possess different finite Lagrangian and different Lagrangian density distribution in three space.

The gauge potentials of the Type A solutions are singular at only one point at infinity on the negative z-axis whereas the Type B solutions are singular at only one point at infinity on the positive z-axis. The 't Hooft magnetic fields of these solutions at spatial infinity correspond to the magnetic field of a positive one-half monopole located at the origin, $r = 0$, and a semi-infinite Dirac string singularity located on one-half of the z-axis which carries a magnetic flux of $\frac{2\pi}{g}$ going into the center of the sphere at infinity. Hence the net magnetic charge of the configuration is zero. These solutions do not satisfy the first order Bogomol'nyi equations and are non-BPS solutions even in the BPS limit of vanishing Higgs self-coupling as their Lagrangian densities do not vanish over all space and their Lagrangians are finite quantities when $\lambda = 0$. When $\lambda = 0$, the dimensionless total energy of the one-half monopole located at $r = 0$ of the Type 1 solutions is 0.51 and the that of the Type 2 solutions is 0.53. Hence the total energies of these one-half monopole solutions are larger than the dimensionless total energy of the BPS solution which is 0.50. The total energies of these one-half monopole solutions are calculated for various strength of the Higgs field self-coupling constant λ from zero to 100 and they are found to increase logarithmically with λ.

Primary author: Prof. TEH, Rosy (Universiti Sains Malaysia (MY))

Co-authors: Mr NG, Ban-Loong (Universiti Sains Malaysia); Dr WONG, Khai-Ming (Universiti Sains Malaysai (MY))

Presenter: Prof. TEH, Rosy (Universiti Sains Malaysia (MY))

Session Classification: TR 12 - Formal Theory Development & TR 1 - The Standard Model

Track Classification: Track 12. Formal Theory Developments