

4th International Conference on

ASTROPHYSICS AND PARTICLE PHYSICS

December 03-05, 2018 | Chicago, USA

Witten effect and fractional charges on the domain wall and the D brane like dot

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The three-dimensional topological insulators BiSb in a certain range composition has been predicted, and Dirac fermions on the surface of these topological insulators have been observed by angle-resolved photoemission spectroscopy. Also, Castelnovo et.al have proposed that magnetic monopoles emerge in a class of exotic magnets known collectively as spin ice components $\text{Dy}_2\text{Ti}_2\text{O}_7$ and $\text{Ho}_2\text{Ti}_2\text{O}_7$. The present authors have proposed that there might be emergent quasi particles with a fractional electronic charge such as dyons on the domain wall between topological insulators and spin ice components through the Witten effect and interaction between the Dirac fermions and excited magnetic monopoles. In addition, the present author has discussed the origin of the anomalous excitations in the quantum semiconductor-dot, which might correspond to exotic excitations with fractional charges. Furthermore, we will discuss the anomalous excitations on the domain wall and the D-brane-like dot, and the relation to low energy hadron in QCD, from viewpoint of field-theoretical formula.

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