

M-branes and Lie 3-algebra

High Energy Accelerator Research Organization (KEK) Shotaro Shiba
E-mail: sshiba@post.kek.jp

Recently, the relation of M-branes and Lie 3-algebra has been gradually clarified. This algebra can be a gauge symmetry of M-brane worldvolume theory. M2-brane theory with Lie 3-algebra is known as BLG theory [1], and M5-brane theory is known as Nonabelian (2,0) theory [2].

We know, at this time, three kinds of Lie 3-algebra which lead to physical theories: \mathcal{A}_4 algebra, Nambu-Poisson bracket and Lorentzian algebras. Their physical interpretation has been also understood. In particular, Nambu-Poisson bracket is related to the extension of worldvolume to some manifold [3, 4]. Lorentzian algebras are related to the compactification of worldvolume and T-duality [5, 6, 7].

Therefore, by concrete analysis of M-brane theory with each example of Lie 3-algebra, we can show that other M- or D-brane theory can be reproduced. Also, in the cases of Lorentzian algebras, the relation among U-duality parameters can be reproduced. Such discussion suggests that the original theories surely grasp some aspects of M-branes.

However, we are not satisfied fully with these results, since the branes which cannot be reproduced by this discussion still remain. The improvements towards this direction must be an important future work.

References

- [1] J. Bagger and N. Lambert, Phys. Rev. **D77** (2008) 065008.
- [2] N. Lambert and C. Papageorgakis, JHEP **1008** (2010) 083.
- [3] P.-M. Ho, Y. Imamura, Y. Matsuo and S. Shiba, JHEP **0808** (2008) 014.
- [4] C.-S. Chu, P.-M. Ho, Y. Matsuo and S. Shiba, JHEP **0808** (2008) 076.
- [5] P.-M. Ho, Y. Matsuo and S. Shiba, JHEP **0903** (2009) 045.
- [6] T. Kobo, Y. Matsuo and S. Shiba, JHEP **0906** (2009) 053.
- [7] Y. Honma, M. Ogawa and S. Shiba, JHEP **1104** (2011) 117.