This article deals with applications of the generalized Calabi-Yau manifold, which is defined by Hitchin in [1], to the description of supersymmetric flux backgrounds of string and M theories. Motivation of the study is to consider solutions for flux compactifications in these theories in terms of Hitchin's generalized geometry. Thus, in order for the reader to appreciate the article, it is necessary to have familiarity to at least (a) geometry of supersymmetric backgrounds of string and M theories with (and without) fluxes, and (b) previous key results in the applications of Hitchin's generalized manifold to string and M theories. These are demanding topics to fully comprehend for the reader with little backgrounds. In what follows I try to briefly describe basics of these materials.

Regarding (a), it has been known that the so-called G-strucure (see , e.g., [2]) is useful in geometric studies of obtaining solutions for the compactifications of string theory. In particular, in the absence of the fluxes the solutions can be characterized by torsion-free G-structure. This leads to the fact that the solutions can be classified by special holonomy manifolds which admit parallel (or covariantly constant) spinors. Typical examples include Calabi-Yau manifolds with $SU(n)$ holonomy and seven-dimensional spin manifolds with G_2 holonomy.

In the presence of the fluxes, however, the fluxes break torsion-free (or integrability) conditions and the background manifolds no longer have special holonomy. Use of Hitchin's generalized geometry, however, circumvents the situation (see, e.g., [3]). For example, introducing a notion of "generalized" G-structure, one can analyze the flux backgrounds in a more extended and systematic way than before.

This article needs to be understood along the lines of the above progress. It sheds new light on the integrability for generalized G-structure and shows that $\mathcal{N} = 1$ supersymmetric flux backgrounds of string and M theories correspond to conditions that "intrinsic torsions" of the generalized G-structure vanish. The authors call the emergent manifolds "generalized special holonomy" as these can be interpreted as analogs of the ordinary special holonomy in the generalized manifold. The authors also present a list of relevant holonomy groups for $D = 4, 5, 6, 7$ dimensions. Throughout the article backgrounds of D dimensional (generalized) Minkowski spaces are considered. Further studies show that the similar results can be obtained for AdS background as well [4]. For recent progress on the cases of $\mathcal{N} \geq 2$ and other algebraic sophistications with the so-called Kosmann-Dorfman bracket, see [5].

References

[1] N. Hitchin, Quart. J. Math. **54**, 281 (2003) doi:10.1093/qjmath/54.3.281 [math/0209099 [math-dg]].

[2] J. P. Gauntlett, D. Martelli, S. Pakis and D. Waldram, Commun. Math. Phys. **247**, 421 (2004) doi:10.1007/s00220-004-1066-y [hep-th/0205050].

[3] M. Grana, R. Minasian, M. Petrini and A. Tomasiello, JHEP **0408**, 046 (2004) doi:10.1088/1126-6708/2004/08/046 [hep-th/0406137].

[4] A. Coimbra and C. Strickland-Constable, arXiv:1504.02465 [hep-th].

[5] A. Coimbra and C. Strickland-Constable, arXiv:1606.09304 [hep-th].