

## The heterotic $G_2$ system on contact Calabi–Yau 7-manifolds

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We obtain non-trivial solutions to the heterotic  $G_2$  system, which are defined on the total spaces of non-trivial circle bundles over Calabi–Yau 3-orbifolds. By adjusting the  $S^1$  fibres in proportion to a power of the string constant  $\alpha'$ , we obtain a cocalibrated  $G_2$ -structure the torsion of which realises an arbitrary constant (trivial) dilaton field and an  $H$ -flux with nontrivial Chern–Simons defect. We find examples of connections on the tangent bundle and a non-flat  $G_2$ -instanton induced from the horizontal Calabi–Yau metric which satisfy together the anomaly-free condition, also known as the heterotic Bianchi identity. The connections on the tangent bundle are  $G_2$ -instantons up to higher order corrections in  $\alpha'$ .