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[Invited] A portable superconducting cryo-magnet with magnetic field of > 3 T generated by the pulsed field magnetization

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A cryo-magnet system has been constructed using a single grain $\text{GdBa}_{2-x}\text{Cu}_{3-x}\text{O}_{7-\delta}$ (GdBaCuO) bulk superconductor of diameter 30 mm. The bulk superconductor was cooled by conductive cooling, employing a portable Stirling cryo-cooler with a base temperature of 51 K. The superconducting cryo-magnet can be repeatedly charged by a pulsed field magnetization (PFM) system that is considerably compact.

A flux jump behaviour was observed consistently during magnetization when the applied pulsed field, $\frac{dB}{dt}$, exceeded a critical value (e.g. 3.78 T at 60 K). A sharp $\frac{dI}{dt}$ is essential to this phenomenon. This flux jump behaviour enables the magnetic flux to penetrate fully to the centre of the bulk superconductor, resulting in full magnetization of the sample without requiring an applied field as large as that predicted by the Bean model. We show that this flux jump behaviour can occur over a wide range of fields and temperatures, and that it can be exploited in our practical quasi-permanent magnet system.

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