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Observation of localized, anti-equilibration flow in a quasi-one-dimensional magnetic fluid in horizontal field and temperature gradients WEILI LUO, JUN HUANG, University of Central Florida, TIANSHU LIU, Western Michigan University — Heat flows from high temperature to low temperature in almost all thermal phenomena in nature as well as in our daily life. In this paper we report a counter example: heat is held localized in place, halting the approaching to equilibrium in the system by magnetic body force originated from both temperature and field gradients in a magnetic fluid. Using two different configurations of temperature and magnetic field gradients, we observed magnetic field-induced flows that either enhance the gravito-thermal convection when the gradients of temperature and field are parallel to each other, or suppress it when the two gradients are antiparallel, where the convection roll in zero field was replaced by two localized flows at the two ends of the sample cell. This flow structure stops the heat flow of approaching to thermal equilibrium in the system, causing the temperature difference across the sample to increase with applied fields. The drastically different effects of the magnetic force on the equilibration processes resulted from two totally different topological flow-structures for the two experimental configurations imply a profound bifurcation of solutions for the underlying physics.

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