Convection cells without shear or gravity: Surprises from a simple model in non-equilibrium statistical mechanics

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A clear signature of far-from-equilibrium systems, convection cells are ubiquitous in nature. Typically, they are driven by external forces, like shear or gravity in combination with temperature gradients. Here, we show the existence of such cells in a simple (possibly the simplest) system involving only a temperature gradient. In particular, we study a 2-D Ising lattice gas in contact with two thermal reservoirs. For simplicity, we impose a sharply localized temperature gradient. With the higher T maintained at "infinity" while setting the lower T below the Onsager temperature, convection cells emerge. Other motivations, further surprises, and some theoretical considerations, will also be presented.