Abstract Submitted
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Elevator mode convection in liquid metal blankets for fusion reactors[1] OLEG ZIKANOV, LI LIU, University of Michigan - Dearborn — The work is motivated by the design of liquid-metal blankets for nuclear fusion reactors. Mixed convection in a downward flow in a vertical duct with strong contant-rate heating of one wall (the Grashof number up to 10^{12}) and strong transverse magnetic field (the Hartmann number up to 10^4) is considered. It is found that in an infinitely long duct the flow is dominated by exponentially growing elevator modes having the form of a combination of ascending and descending jets. An analytical solution approximating the growth rate of the modes is derived. Analogous flows in finite-length pipes and ducts are analyzed using the high-resolution numerical simulations. The results of the recent experiments are reproduced and explained. It is found that the flow evolves in cycles consisting of periods of exponential growth and breakdowns of the jets. The resulting high-amplitude fluctuations of temperature is a feature potentially dangerous for operation of a reactor blanket.

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