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Mixed convection in duct flows with very strong transverse magnetic fields[1] XUAN ZHANG, XINYAN LV, LI LIU, ANDREW SCHIGELONE, OLEG ZIKANOV, University of Michigan - Dearborn — Mixed convection in flows of liquid metals within ducts with one heated wall and imposed transverse magnetic field is studied using high-resolution DNS and linear stability analysis. The main attention is given to the cases of strong heating (the Grashof number up to 10^{12}) and strong magnetic field (the Hartmann number up to 800). Various orientations of the duct, temperature gradient, and magnetic field are studied in our project. This presentation is focused on the configuration of a horizontal duct with bottom heating and horizontal transverse magnetic field. It is found that, while conventional turbulence is suppressed, a new type of convection instability appears at high Hartman numbers. The most unstable modes are the rolls aligned with the magnetic field. Their streamwise wavelength is of the order of the width of the duct and decreases with the Hartmann number as the rolls become localized in the lower part of the duct. In fully developed secondary regimes, transport of the rolls by mean flow leads to strong low-frequency oscillations of local temperature.

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