Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Point dipole as a magnetic obstacle in liquid metal duct flow[1]
SASKIA TYMPEL, THOMAS BOECK, DMITRY KRASNOV, JÖRG SCHUMACHER, TU Ilmenau — Lorentz force velocimetry is a new contactless technique to measure the velocities of hot and agressive conductiong liquids. The measurement of the Lorentz force on the magnet is highly sensitive to the velocity profile that is influenced by the magnetic field. Thus the knowlegde of the flow transformation and the influence of an inhomogeneous local magnetic field on liquid metal flow is essential for obtaining velocity information from the measured forces. We consider liquid metal flow in a square duct with electrically insulating walls under the influence of a magnetic point dipole using three-dimensional direct numerical simulations with a finite-difference method. The dipole acts as a magnetic obstacle. A wide range of parameters affects the created wake. In this canonical setting, we study the modification of the flow for different Hartmann and Reynolds numbers. We observe a strong dependence of the magnetic obstacle effect and the corresponding Lorentz force on the orientation of the dipole as well as on its position.

[1]The authors acknowledge the support of the Deutsche Forschungsgemeinschaft.

Saskia Tympel
TU Ilmenau

Date submitted: 11 Aug 2011 Electronic form version 1.4