

# Soft iron impellers: induction mechanism and dynamo

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The VKS experiments have shown a remarkable variety of dynamo regimes in a von Kármán (VK) flow of liquid sodium, with following main characteristics which we want to address: i) dynamo action has only been observed when soft iron impellers are used to drive the fluid motion, ii) for exact counter-rotation of the impellers, the magnetic field generated is an axial dipole whereas numerical simulation which do not include ferromagnetic boundaries predict a transverse dipole, iii) when the forcing is asymmetric, dynamical regime may occur and can be described by a low dimensional involving only 2 magnetic modes.

In order to understand the role of soft iron, we have studied induction processes in a gallium von Kármán flow, with impellers made of different materials (stainless steel, soft iron and copper). Our results show that the soft iron promotes induction processes localized near the impellers. Extending our results to VK flows in liquid sodium (at significantly higher magnetic Reynolds numbers), we propose a mechanism for dynamo generation in VKS. This mechanism successfully accounts for the 3 points mentioned above.