

Abstract Submitted
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VKS: a turbulent homogeneous dynamo with liquid sodium¹

MICHAEL BERHANU, Ecole Normale Supérieure — The magnetic field of the earth and of most astrophysical objects result from turbulent flows of electrically conducting fluids: the kinetic energy of the flow is converted into magnetic energy by dynamo effect. In September 2006 we observed this effect for the first time in a closed homogeneous turbulent flow of liquid sodium at very high Reynolds number in the Von-Karman Sodium (VKS). Despite the strong level of the fluctuations of the flow, we observed the growth and saturation of a stationary global mode of the magnetic field at the experiment's characteristic length. Does turbulence act as noise or does it participate in the magnetic generation process? If we modify the global properties of the flow, we observe transitions between different magnetic field modes, going from stationary to oscillatory, and, near the frontiers between these modes, interesting dynamical behaviours occur, such as bursts and relaxations cycles. In particular we found a state with reversals of the magnetic field similar to those of the Earth recorded on geological time scale. These evolutions present some features of low dimensional chaos, compatible with the interaction between few modes. Finally we observe for the first time bistability from a stationary dynamo to an oscillatory one.

¹VKS collaboration: ENS, CEA Saclay, ENS Lyon.

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