MSc+PhD ON MAGNETOCONVECTION BEYOND THE CHANDRASEKHAR LIMIT

under the joint supervision of

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A PhD position in experimental fluid mechanics is open at the High Magnetic Field Laboratory in Grenoble (CNRS/ France). The topic concerns the experimental study of Rayleigh-Bénard convection under the influence of high magnetic fields. This type of convection plays a crucial role in numerous natural and industrial processes: for example in the tachocline layer of the Sun, in the liquid core of the Earth, but also in material processing such as the pulling of silicon ingots or the continuous casting of metallic alloys. In general, magnetic fields introduce a dissipative mechanism through the Joule effect which tends to damp, or even suppress convection. This has an impact on characteristic patterns that form in a convective flow. Chandrasekhar (Physics Nobel Prize 1983) derived the theoretical value of the critical Rayleigh number beyond which convection survives for a given magnetic field in the ideal case of a fluid layer confined between two infinite planes. Nevertheless, when lateral walls are present, convective plumes could potentially persist below this limit and thus locally promote enhanced heat fluxes.

This effect has, until now, never been observed in the laboratory, partly because typical electrically conducting fluids are opaque and thus hard to probe. The purpose of this PhD project is to observe the impact of strong magnetic fields on the formation of convective structures and to characterise these states and their possible transition into turbulent convection. For this, the student will be taking advantage of a new technique recently developped by the groups in Coventry and Grenoble, which consists of using a weakly conducting but transparent electrolyte placed in very high magnetic fields. This technique makes it possible to obtain precise maps of the velocity fields by means of advanced optical measurement methods using laser imaging technology (such as Particle Image Velocimetry or Laser Doppler Anemometry).

The PhD student will be in charge of this experimental project and will collaborate with theoreticians from TU Ilmenau in Germany who will be conducting numerical simulations of this problem in parallel, to compare the results.

Candidates must have a master degree in engineering or physics (300 ECTS credit points) and be movitated to conduct technically advanced experimental projects. Experience in fluid mechanics and/or measurement technology is welcomed. The PhD will benefit from a Co-tutelle between Coventry University (UK) and TU Ilmenau (Germany) leading to a PhD award in each university. The work will be physically based in the laboratory in Grenoble (France) for most of the time with extended stays at sites in the UK and Germany. The position runs for a period of three years and is expected to start in spring 2019.

To apply, please send a CV and a full transcript of academic records to:

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