Slow dynamics of turbulent flows in a von Kármán experiment

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In this talk we will review different dynamics that appear in a closed flow. We will focus on the slow scales (larger than any one of the injection temporal scales). The experimental volume is a closed cylinder with diameter $D = 20$cm and $H = 20$cm. Two impellers of diameter $D_{prop} = 17.5$cm with 10 curved blades rotate in opposite directions, powered by two independent motors regulated through a computer. The rotation frequency of the propellers can be adjusted independently. A key characteristic of this setup is the high inertia of the propeller and motor set and the high stability of the propellers, i.e. the instantaneous fluctuations of each one of the propeller's velocities are well below one part in one thousand 0.1%.

The flow consists on two strong recirculations that collide in a narrow region where these slow dynamics are triggered. Two different regimes will be analyzed, the very slow regime, where random jumps between different solutions have been characterized [1] and the slow regime, where it has been observed an inverse cascade that can be explained as the transfer of angular momentum between the diferent fluid layers [2].

With these results as an starting point, a new experiment in Helium superfluid has been run in the Superfluid Helium Facility (SHREK) in Grenoble, where a Reynolds number of 10^8 has been reached.

[1] de la Torre. A; Burguete J **Phys Rev Lett 99** (2007) 054101.
[2] López-Caballero, M; Burguete J **Phys Rev Lett 110**(2013)124501.