Proposed nonlinear energy transfer, momentum transport, and hysteresis experiments on HL-2A

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In order to find the direct microscopic evidences that shear/zonal flows are really generated by turbulence through nonlinear processes, and quantify the branching ratio of energy between turbulence and zonal flows and the effectiveness of the shear/zonal flows back-reaction on turbulence, as well as to get more insight for the bifurcation problem from the microscopic view, two sets of experiments have been proposed on the HL-2A tokamak at the Southwest Institute of Physics (SWIP) in China. One set of experiments is to use Langmiur probe arrays to directly measure the frequency domain nonlinear energy transfer rate, vorticity flux and Reynolds stress profiles as the plasma approaches the L-H transition. A 3x3 probe array will be sufficient for measuring all of the above quantities. Another set of experiments is to measure the particle flux $\langle \tilde{n}\tilde{v}_r \rangle$, Reynolds stress $\langle \tilde{v}_r \tilde{v}_\theta \rangle$, vorticity flux $\langle \tilde{v}_r \tilde{\omega} \rangle$, etc. vs. density and velocity gradients during the L-H and H-L transition phases. In other words, we will be able to map out the s-curve typical in the bifurcation process using the experimental data. This for sure will greatly contribute to our understanding of the bifurcation problem from the microscopic view, and technically will benefit the HL-2A machine performance. The experiments will be carried out during the next campaign (March to May 2011).