Energy transfer between streamers and zonal flows via shear flow instabilities

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One important issue in turbulence self-organization is the interplay between the Kelvin-Helmholtz (KH) instability and the streamers and/or the zonal flows. This question has been debated for a long time. The problem of their interaction involves low frequency and large scale lengths, therefore requiring long simulation runs that enable to study their dynamics on long time scales. In order to investigate the role of the KH instability and its position in the sequence of events between streamers and zonal flows, we use a reduced model based on low frequency trapped-ion driven modes. This model represents a complementary and useful approach with respect to gyrokinetic models, because it requires less numerical resources whilst keeping the essential physical ingredients. We perform several simulations and we show that the energy pumped in the system by the primary instability associated to trapped ion modes can be exchanged between streamers and zonal flows. The energy transfer occurs via the KH instability that can develop along these structures as a consequence of their associated shear flows. In particular we show that the transfer of energy is regulated by the orientation of the elongated KH vortices with respect to the velocity shear direction associated to streamers and zonal flows respectively.