Global Well-posedness of an Inviscid Three-dimensional Pseudo-Hasegawa-Mima-Charney-Obukhov Model

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The 3D inviscid Hasegawa-Mima model is one of the fundamental models that describe plasma turbulence. The same model is known as the Charney-Obukhov model for stratified ocean dynamics, and also appears in literature as a simplified reduced Rayleigh-Bénard convection model. The mathematical analysis of the Hasegawa-Mima and of the Charney-Obukhov equations is challenging due to the their resemblance with the Euler equations. In this talk, we introduce and show the global regularity of a model which is inspired by the inviscid Hasegawa-Mima and Charney-Obukhov models, named a pseudo-Hasegawa-Mima model. The introduced model is easier to investigate analytically than the original inviscid Hasegawa-Mima model, as it has a nicer mathematical structure. To establish our global regularity result we implement a new logarithmic inequality, generalizing the Brezis-Gallouet-Berzis-Wainger inequalities. (This is a joint work with C. Cao and A. Farhat.)