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A field theoretical model of self-organization of the vorticity field in two-dimensional plasma and in planetary atmosphere FLORIN SPINEANU, MADALINA OLIMPIA VLAD, NILPRP — Starting from plasma/fluids models of interacting point-like vortices we develop a field theoretical description for the 2D Euler fluid (non-dissipative incompressible fluids) and for the 2D plasma in strong magnetic field (Hasegawa-Mima) and planetary atmosphere (Charney) fluids. We find the Lagrangian densities and action functionals, and derive the equations of motion. We prove that between the states that attain the extrema of the action there is a subset of stationary states that correspond to absolute minima and are reached by the system asymptotically. We show that they are respectively described by the sinh-Poisson equation (confirming by purely analytical means a previous result) and by a new equation for 2D plasma and atmosphere. Solving numerically the second equation we show that it reproduces large scale 2D flows in tokamak plasma. We argue that the states of high confinement are connected with states of organization of plasma vorticity.

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