GUALTIERO BADIN, University of Hamburg
Hydrodynamic Nambu Brackets derived by Geometric Constraints

A geometric approach to derive the Nambu brackets for ideal two-dimensional (2D) hydrodynamics is suggested. The derivation is based on two-forms with vanishing integrals in a periodic domain, and with resulting dynamics constrained by an orthogonality conditions. As a result, 2D hydrodynamics with vorticity as dynamic variable emerge as a generic model, with conservation laws which can be interpreted as enstrophy and energy functionals. Generalized forms like surface quasi-geostrophy and fractional Poisson equations for the stream-function are also included as results from the derivation. The formalism is then extended to a hydrodynamic system coupled to a second degree of freedom, with the Rayleigh-Benard convection as an example. This system is reformulated in terms of constitutive conservation laws with two additive brackets which represent individual processes: a first representing inviscid 2D hydrodynamics, and a second representing the coupling between hydrodynamics and thermodynamics. The results can be used for the formulation of conservative numerical algorithms that can be used, for example, for the study of fronts and singularities.