



LEZIONE LAGRANGIANA

Prof. Yvette Kosmann-Schwarzbach

Centre de Mathématiques Laurent Schwartz, École Polytechnique, Paris

A study in compatibility: Multiplicative geometric structures
on Lie groupoids

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Aula Magna del Dipartimento di Matematica

Via Carlo Alberto 10, Torino

ABSTRACT: Poisson structures on smooth manifolds are the 20th-century avatar of Lagrange's parentheses of 1808 and Poisson's brackets of 1809. When, in particular, the manifold in question is a Lie group, the group structure and the Poisson structure are assumed to satisfy a compatibility condition, called the 'multiplicativity' of the Poisson tensor. This is the essence of Drinfeld's note, 'Hamiltonian structures on Lie groups, Lie bialgebras and the geometric meaning of the classical Yang-Baxter equations' (1983), that preceded his ICM lecture on quantum groups. The development of this idea leads to the notion of multiplicative multivectors (contravariant skew-symmetric tensor fields) of any order, and to the determination and study of their infinitesimal counterparts, and it has been carried out by many mathematicians (Alan Weinstein, Kirill Mackenzie, Ping Xu, among many others) since the late 1980's. But when searching for the corresponding theory of multiplicative differential forms, no such non-trivial objects have been found to exist on Lie groups and one enters the differential geometry of Lie groupoids, perforce enlarging the quest for multiplicative objects from groups to groupoids. It was a long development until the definitions, properties, infinitesimal counterparts and integration theorems were obtained for the general case of multivector-valued differential forms of all orders on Lie groupoids (Bursztyn and Drummond, 2019). Meanwhile, the notion of multiplicativity was extended to the generalized complex structures on Lie groupoids (Jotz, Stiénon and Xu, 2016), but generalized geometry is another (interesting) story.