Third International Conference on
Geometry, Integrability and Quantization
June 14–23, 2001, Varna, Bulgaria
Ivaïlo M. Mladenov and Gregory L. Naber, Editors
Coral Press, Sofia 2001, pp 442–453

ANOTHER PERSPECTIVE ON THE RELATION BETWEEN CLASSICAL AND QUANTUM INTEGRABILITY

JEAN-CLAUDE ZAMBRINI[†] and NENAD MANOJLOVIČ[‡]

[†] *GFM, Av. Prof. Gama Pinto 2, 1649-003 Lisboa, Portugal*

[‡] *Área Departamental de Matemática, F.C.T., Campus de Gambelas Universidade do Algarve, 8000-117 Faro, Portugal*

Abstract. We describe a framework suggesting how to "deform" in Planck's constant $\hbar$ the classical concept of integrability. The key point is to use well defined counterparts of Feynman's measure on the space of paths of the mechanical system. Then we introduce the associated deformation of quantum conservation laws. The method is tested on elementary systems and provide, indeed, more information than expected.

1. Motivation

This is a brief report on some qualitative aspects of the relations between the classical notions of integrability and their quantum counterparts. We wish to advocate an approach to this question which is certainly not mainstream but seems to us conceptually natural, as well as to provide a few arguments showing why we believe that it is indeed promising. The full realization of this research program may, however, take years so we will somehow abuse the hospitality of Professor Ivailo Mladenov, hoping to be able to prove in a future Varna Conference on *Geometry, Integrability and Quantization*, that the program sketched in the 2001 edition was, indeed, sound!

In mathematical physics, the motivation for studying together the two above-mentioned notions of integrability can be traced back to the need to define the quantization of classical systems whose behavior is conflicting as much as possible with the one of integrable systems, the ergodic ones. This is one way to approach "quantum chaos", not optimal however since it is not really an intrinsic quantum mechanical definition [1, 2]. But, at least, this per-