



GEOMETRIC METHODS IN QUANTUM MECHANICS*

MAURO SPERA

*Dipartimento di Informatica, Università di Verona
Ca' Vignal 2, Strada le Grazie 15, 37134 Verona, Italy*

Abstract. This is a survey on geometric quantum mechanics and some of its implications on general issues in quantum theory.

CONTENTS

1. Introduction	44
2. Preliminary Tools	45
2.1. Some Basic Symplectic Geometric Terminology	45
2.2. Complex Polarizations and Kähler Manifolds	45
2.3. A Digression on Geometric Invariant Theory	46
2.4. Completely Integrable Hamiltonian Systems	46
2.5. A Glimpse at Geometric Quantization	47
2.6. The Bohr-Sommerfeld Condition	48
2.7. Holomorphic Geometric Quantization	49
2.8. A Hydrodynamical Intermezzo	50
3. Geometric Quantum Mechanics: the Basic Formalism	52
3.1. Projective Space and its Symplectic and Kähler Geometry	53
3.2. The Chern-Bott Connection	55
3.3. Toral Actions and Integrability	56
3.4. Uncertainty and Jacobi Fields	59
3.5. Hydrodynamical Aspects of Geometric Quantum Mechanics	60
3.6. Aharonov-Anandan Phase for Mixed States	62

*Reprinted from *J. Geom. Symmetry Phys.* **24** (2011) 1–44.