Geometry,
Integrability
and
Quantization

LECTURES ON GEOMETRIC QUANTIZATION

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Abstract. These lectures notes are meant as an introduction to geometric
quantization. In Section 1, I begin with presentation of the historical back-
ground of quantum mechanics. I continue with discoveries in the theory of
representations of Lie groups, which lead to emergence of geometric quan-
tization as a part of pure mathematics. This presentation is very subjective,
flavored by my own understanding of the role of geometric quantization in
quantum mechanics and representation theory. Section 2 is devoted to a re-
view of geometry of Hamiltonian systems. Geometric quantization is dis-
cussed in the next two sections: prequantization in Section 3 and polariza-
tion in Section 4. In particular, I discuss geometric quantization with respect
to polarizations given by Kähler structure, cotangent bundle projection and
completely integrable system. More advanced topics, like metaplectic struc-
ture, pairing of polarizations, and commutation of quantization and reduc-
tion, are not included.

MSC: 53-D-50, 53D50, 81S10
Keywords: Bohr-Sommerfeld quantization, co-adjoint orbits, geometric quan-
tization, polarization, prequantization, reduction of symmetries, representa-
tions of Lie groups, symplectic geometry

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