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Semiclassical quantization of atomic systems through their normal form: The hydrogen atom CHARLES JAFFÉ, Department of Chemistry, West Virginia University, PATRICIA YANGUAS, JESÚS PALACIÁN, Departamento de Ingeniería Matemática e Informática, Universidad Pública de Navarra, 31006 Pamplona Spain, T. UZER, Center for Nonlinear Sciences, School of Physics, Georgia Institute of Technology, Atlanta, GA 30332-0430, USA — Over a century after Bohr's the initial quantization of hydrogen, the semiclassical quantization of atomic systems still represents a challenge. In the present paper we re-examine the semiclassical quantization of hydrogen asking the question: *How can hydrogen be quantized without making use of its separability?* The approach adopted was to explicitly a construct transformation from the physical variables to the action-angle variables. The initial difficulty encountered is the lack of an equilibrium point on the potential energy surface. To surmount this difficulty, it is noted that the circular periodic orbits are relative equilibria. In a rotating frame the relative equilibria become critical points in the phase flow. It is shown that the flow in the vicinity of the critical point is stable. The Lie-Deprit transformation is then used to transform the system into normal form, following which the semiclassical quantization is straightforward.

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