Classical and Semiclassical description of Rydberg excitons in cuprous oxide

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The seminal work of Kazimierczuk et. al. revealed the existence of exciton states in cuprous oxide up to high principle quantum numbers, with extensions up to the µm range [1]. While the dominant structures in the spectra can be understood in terms of a hydrogen-like Rydberg series, a more detailed investigation reveals the splitting of different *l*-manifolds and even a hyperfine splitting for the exciton states [2]. For highly excited Rydberg states, the correspondence principle should hold and quantum mechanics turn into classical mechanics. This raises the question of how the classical dynamics for excitons in cuprous oxide look like, and whether one can understand quantum spectra in terms of classical orbits. In my talk I will discuss classical dynamics of the yellow exciton series and its relation to the corresponding quantum spectra [3,4], as well as the dynamics of the green series, which exhibit large chaotic regions in phase space [5].

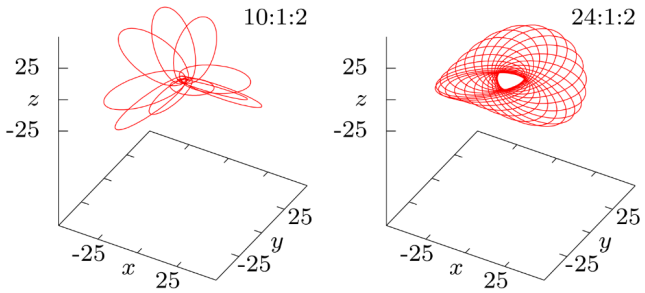

Fig. 1. Yellow exciton orbits at energy corresponding to principle quantum number n=5 in the hydrogen-like case.

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