Name-Surname	**George Datseris**
Thesis Title	*Quasi-classical magneto-transport in graphene antidot super-lattices*
Supervisor	G. P. Triberis, Professor
Summary	Grahpene is a material that is strictly two-dimensional in nature and composed solely of carbon atoms. Since the first observation of an isolated graphene monolayer in 2004 it became clear that graphene possesses unique electronic, optical and mechanical properties leading to a tremendous outburst of scientific activity in numerous areas, like solid state physics, chemistry and engineering. New substrate materials now make it possible to fabricate high mobility, gated graphene samples that allow the observation of ballistic transport phenomena. Very recently (Nov. 2015) graphene samples patterned with antidot super-lattices (ADSLs) were fabricated that for the first time showed commensurably effects between the super-lattice and the cyclotron motion of the electrons in a magnetic field. We study ballistic magneto-transport in graphene ADSLs in a quasi-classical approach. By the addition of appropriate adjustments, we develop a theoretical model that extends models that were successfully used to describe the electron dynamics in the modulated two-dimensional electron gases of semiconductor lateral surface superlattices. Our model is very rich in nonlinear phenomena which we thoroughly explain using various techniques from nonlinear dynamics. Examples of these phenomena are the commensurability peaks due to nonlinear resonances and hierarchies of partial transport barriers in phase space, or the negative Hall-resistance due the negative cross-correlation tails of the channeling orbits. We compare our model simulations to experimental data and find overall very good agreement both qualitatively and quantitatively. However, some characteristic discrepancies, especially in the small magnetic field regime, shed new light onto the scattering of the carriers by disorder and imperfections in the specific experiment. Based on the results of this comparison, we implement a first extension to our model incorporating the non-homogeneity of the antidot diameters in the experiment, and propose additional extensions which will be tested in future studies. In addition we suggest an extension of our study towards parameter regimes, not yet studied in experiments, with anomalous non-isotropic cyclotron motion promising new, more complex incommensurability effects.
Key words	ballistic, transport, graphene, quasi-classical, antidots
Evaluation committee	G. P. Triberis, Associate Professor N. Sarlis, Associate Professor T. Geisel