MASTER DE PHYSIQUE ET APPLICATIONS - 2ème année
Spécialité Sciences des Matériaux et Nano-objets
International Nanomat Master Program

Internship proposal 2010-2011

Laboratory : Institut des NanoSciences de Paris

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Title for the scientific project

MBE growth and STM studies of self-assembled quantum dot molecules

Scientific project :

Solid state quantum dots are potential building blocks for quantum computers. However, since it is only possible to carry out one or two qubit operations with a single dot, it is necessary to scale up the number of interacting quantum dots for practical computation.
One attractive solution is to use quantum dot molecules: consisting of two closely spaced, interacting quantum dots.

This is challenging from a fabrication perspective, because of the stochastic nature of quantum dot growth. However, if we manage to pattern the surface with small nanoholes, then we can create preferential nucleation sites for these dots – thereby controlling their position. If we then also tailor the size of the nanohole we can get two dots nucleating in close proximity.

This project consists of two parts:
1. optimising the growth of these quantum dot molecules by molecular beam epitaxy
2. investigating their structure by scanning tunneling microscopy: in particular the effect of the underlying nanohole on the dot shape, and the nature of the interface between the two dots, which has direct consequences for the effectiveness of the inter-dot electronic coupling

If this work is successful then there is the possibility of integrating these nanostructures into devices for optical studies.

Techniques in use :
molecular beam epitaxy, ultra high vacuum techniques, scanning tunneling microscopy

Applicant skills :
Creativity, interest in making novel nanostructures

Granted internship : yes (400€/month)
C'nano IdF laboratory (France only) : yes
Possibility for a thesis : yes (type of grant : Ecole doctorale-UPMC)