# SIMULATION OF LOW TEMPERATURE NON-EQUILIBRIUM PLASMA-ASSISTED SELF-ASSEMBLY OF ORDERED GERMANIUM QUANTUM DOT ARRAYS ON SILICON

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The fabrication of size-uniform, ordered arrays of semiconductor quantum dots (QDs) is a pressing concern for the nanoelectronics industry. To obtain a strong and coherent signal from a QD array, a high degree of control over ordering, both spatial and size is a necessity. Germanium quantum dots in particular, are very promising for optoelectronics, nanoelectronics and quantum information devices [1]. However, traditional fabrication approaches such as molecular beam epitaxy and chemical vapor deposition, fail to provide the precisely ordered QD arrays required for emerging applications. One way to obtain ordered, size-uniform QD arrays is through templating, in particular to create a self-assembled size-uniform pattern of ultra-small quantum dot nuclei (QDN)[1] from which larger QDs may be grown. Using a partially-ionized plasma offers controls with which we may precisely tune the properties of QDN arrays - specifically, the local thermal increase as a result of ion impact and the effect of electric fields on the adatom surface diffusion activation energy [2,3]. Hence we consider the Si(100) substrate as a minefield of thermal or electric field zones, where if an adatom strays into an affected zone it will experience a transient increase in diffusion speed. Properly manipulating these zones through precise control of the low temperature, partially ionized, non-equilibrium plasma environment will lead to more highly ordered (both spatial and size) Ge QDN arrays.

We present a kinetic Monte Carlo (KMC) simulation of the formation of Ge QDs on Si(100) in an ionized gas environment. We will show that a low temperature, non-equilibrium plasma is a more suitable growth environment for the fabrication of ordered Ge QD arrays than a neutral gas-based environment

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