Project proposal

Project title	Computational analysis of colloidal particle interactions
First Supervisor	Professor — Andy Augousti
Second Supervisor	Dr Richard Singer
School	Pharmacy and Chemistry
Other member of supervisory team (no more than three KU supervisors in total)	
Specific requirements beyond 2:1 degree	

Project summary

(max 4,000 characters)

MSc by Research

The interactions between colloidal particles can be modelled using a theory based on functional analysis. The grand free energy of a system of colloidal particles suspended in a liquid solvent may be expressed as a functional of density, charge and polarisation distributions of the liquid, using suitable approximations for the particle pair interactions in terms of the pair correlation function of the liquid solvent. These functionals may be minimised by functionally differentiating and setting to zero, and the resulting integrodifferential
equations solved numerically to give the equilibrium density, charge and polarisation distributions between the colloidal particles. The mean interaction potential between the colloidal particles may then be inferred as a function of separation of these particles. In contrast to classical electrical double layer theories, this formulation produces non-monotonic interaction potentials, which can explain flocculation and coagulation. This interdisciplinary project extends the range of solvents currently studied, and combines physics, chemistry and mathematics with application to areas ranging from food science, petrochemicals, paints and lubricants. It would suit candidates with strong numerical and analytical skills.