2015 YCCSA SUMMER SCHOLARSHIP PROJECT SUBMISSION

This form is for prospective project supervisors to submit their projects to be included in the YCCSA Summer Scholarships Programme for 2015.

It is the purpose of the Summer School that any projects submitted are interdisciplinary in nature.

Date	January 2015
Main Supervisor's Name	Angelika Sebald
Main Supervisor's Department	Chemistry
Co-supervisors' name(s) and Departments	Simon O'Keefe, Computer Science
Project Title	Logic gates based on complex numbers
Project Description	The vast majority of all current computation is based on *binary* logic (using symbols {1,0}). The use of binary is a trade-off between complexity of representation (binary is easy) and the size of the representation (binary is *not* compact). Depending on the intended operations, and on the (potentially unconventional) hardware used, there may well be advantages in considering alternatives to binary logic. For example, if one uses the dynamics of spin-1/2 systems in nuclear magnetic resonance (NMR) for the implementation of classical (as opposed to quantum) computation it appears attractive to use ternary logic (using symbols {+1,0,-1}) [1]. This project will explore how well the dynamics of spin-1/2 systems in NMR can be used to implement logic operations / gates based on complex numbers. The project will include solution-state NMR experiments to corroborate theoretical predictions.
Required skills	Being familiar with Boolean logic and logic gates Being familiar / comfortable with the mathematical description of NMR experiments No previous experience with NMR experiments necessary
Project dates	Starting on Monday, 13 July 2015 and finishing on Friday, 11 September 2015.
Other information	
References	[1] Boolean logic gate design principles in unconventional computers: an NMR case study. M. Bechmann, A. Sebald and S. Stepney, *Int. J. Unconvent. Comp.* **8**, 139-159 (2012).

When complete, please email the form to sarah.christmas@york.ac.uk