School of Computer Science
and Informatics
Cardiff University

Dilute Magnetic Semiconductors for Spintronics: Mn:GaN

FC Langbein

(Cardiff University)

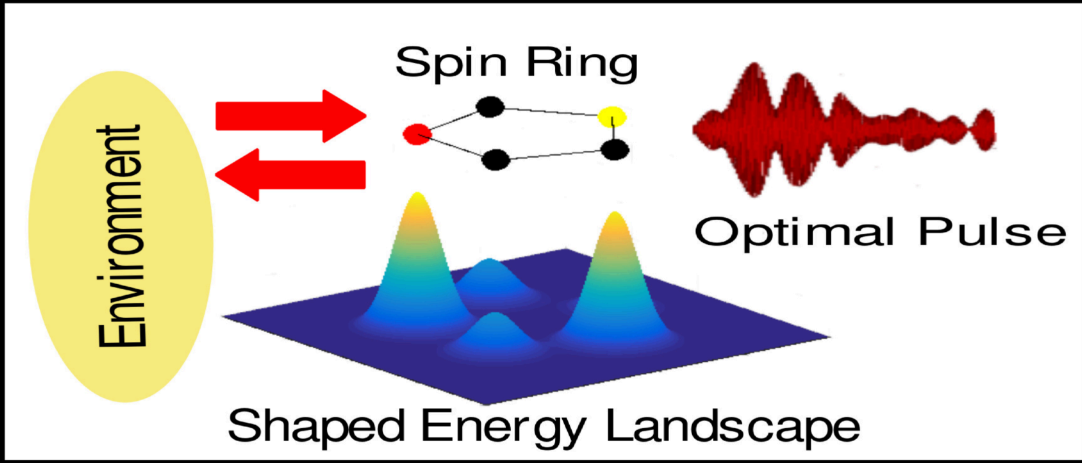
SG Shermer, K Kalna, J Evans, G Burwell

(Swansea University)

Quantum Control

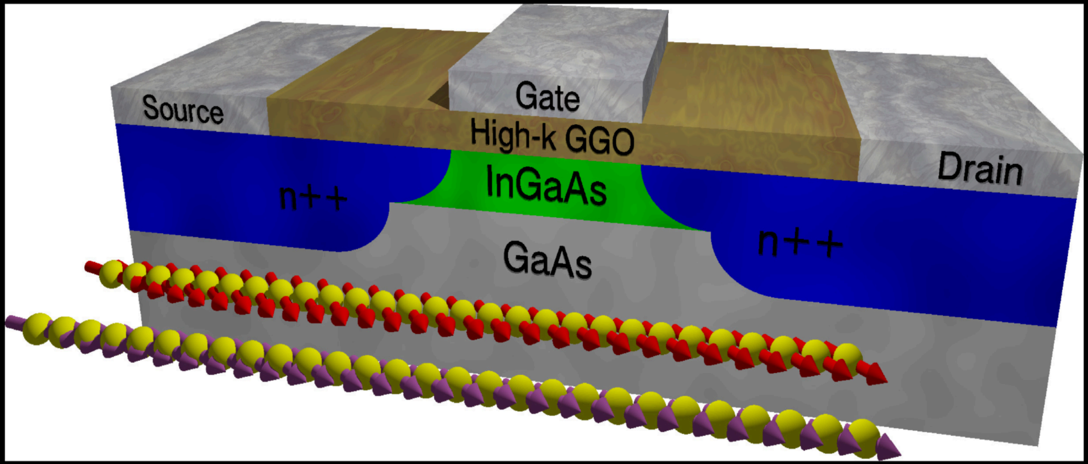
- Find optimal fields u_k to *steer the dynamics* of a quantum system

$$i\hbar\frac{\partial|\Psi\rangle}{\partial t} = \underbrace{\left(H_0 + \sum_k u_k(t)H_k\right)}_{\text{Hamiltonian } H_u}|\Psi\rangle$$



- Using optimisation, simulation, Bayesian parameter estimation, empirical models, reinforcement learning

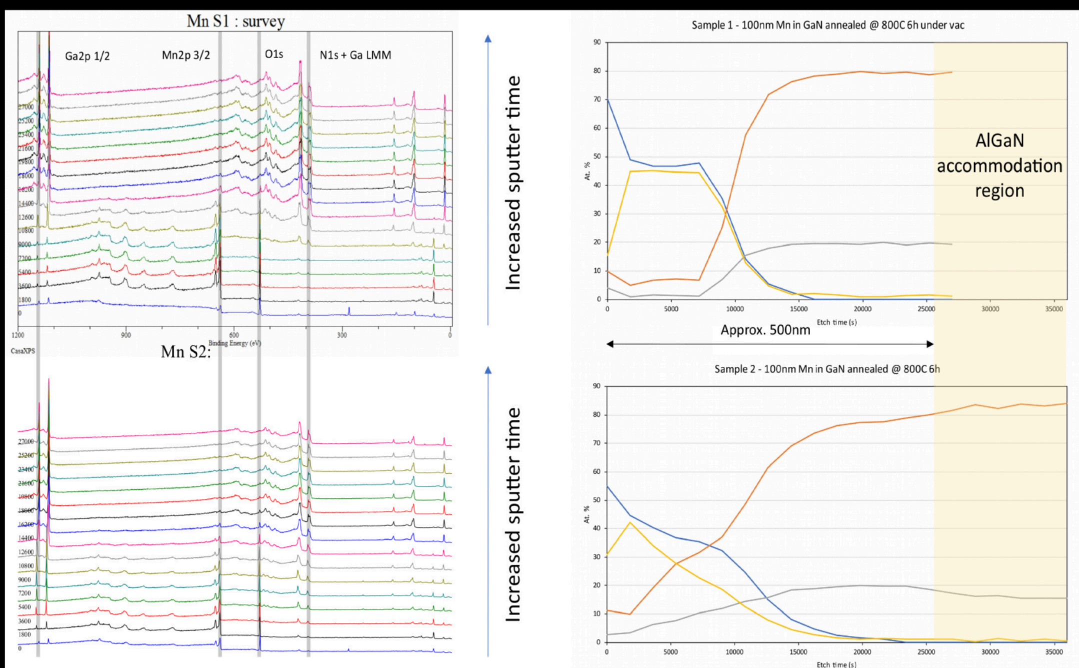
- E.g. controlling spin polarisation in an *InGaAs MOSFET* at room temperature with a Monte Carlo simulator



- Magnetisation refocusing
- Electrical coherent control
- Strain dependence of magnetisation

Dilute Magnetic Semiconductors Mn:GaN

- *Spin injection*: spintronics requires spin-polarised carriers
- Compound semiconductors doped with Ni, Co, Mn, Cr become magnetic
  - Should maintain spin polarisation for injection
  - Literature suggests high Curie temperature and doping possible via thermal annealing



- Initial *characterisation results* of annealed samples
  - MnO layer, negligible diffusion at lower temp.
  - Mn diffusion at higher temp., but damage to (Al)GaN layer

- Next: ion beam implantation or growth?