

## **Topics covered in PHYS598MAP**

### **Quantum Mechanics Technology**

- Angular momentum, irreducible tensors
- Time-independent and time-dependent perturbation theory

### **Atomic Structure**

- Fine structure
- Lamb shift
- Hyperfine structure
- Multi-electron atoms and the quantum defect

### **Interaction with Magnetic Fields**

- Static and time-varying fields
- 2-level systems: the spin-1/2 problem, Rabi oscillations, spin-echo, Ramsey experiment
- Magnetic traps, evaporative cooling

### **Interaction with light**

- Spontaneous emission
- Coherent interactions: stimulated Raman transitions, Lamb-Dicke limit, light shifts
- Optical pumping, laser cooling
- Magneto-optic traps
- Dipole traps, optical lattices

### **Quantum optics**

- The master equation
- Coherent states, squeezed states, thermal states
- EIT, slow light
- Atoms in optical cavities
- STIRAP

### **Interactions between atoms**

- Low-energy collision theory
- Diatomic molecules