**Atomic and Laser Physics Seminar**

**Monday, 12 November**

**11.30**

**Audrey Wood Seminar Room**

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***Quantum state engineering of naturally trapped ions for quantum information and quantum optics***

Rare earth ions in inorganic crystals have free-atom like properties. Optical transitions can be sub-kHz and hyperfine state lifetimes may be days. Using optical-pumping techniques these remarkable properties enable accurate tailoring of the ion absorption profiles. In this way artificial spectral structures are created for targeted purposes.

In an optical cavity made of a rare earth crystal it is straight-forward to create semi-permanent structures that slow down the light propagation by several orders of magnitudes. Such intra-cavity modifications of the light propagation changed the cavity free spectral width and cavity line-width by equally many orders of magnitude. Using these engineered materials, highly efficient (>50%) quantum memories as well as narrow-band optical filters acting as temporal delay lines for medical and other applications are created.

The talk will describe key properties of rare-earth-ion-doped inorganic crystals. Explain how their absorption is modified through irradiation of suitable laser pulses. Give examples of new opportunities that may open up using such quantum-state-engineering-based spectral-tailoring techniques.