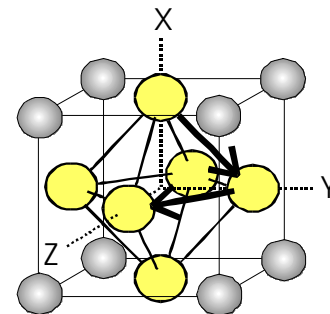


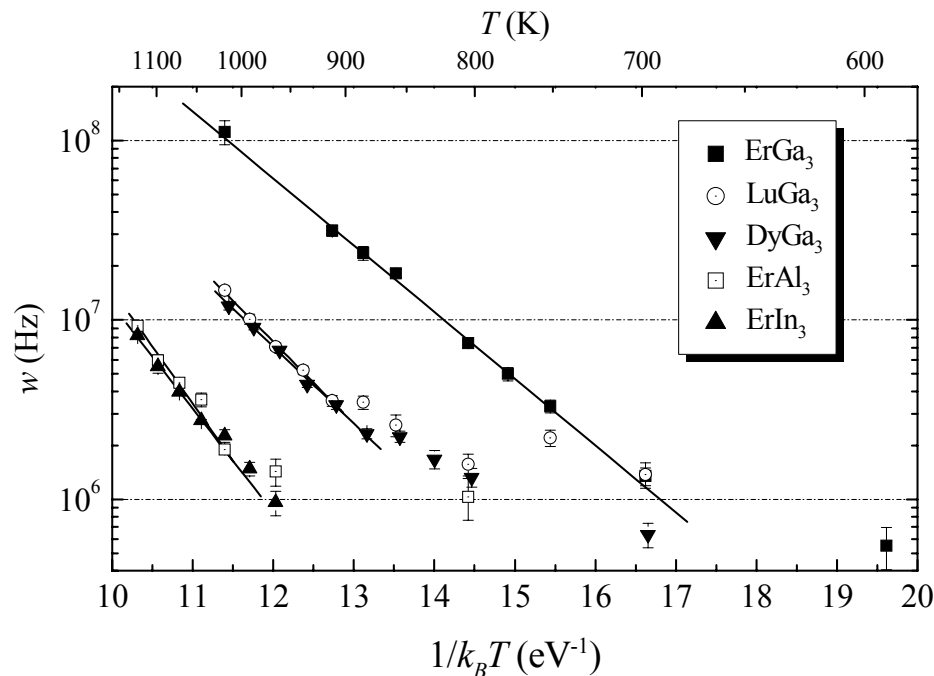
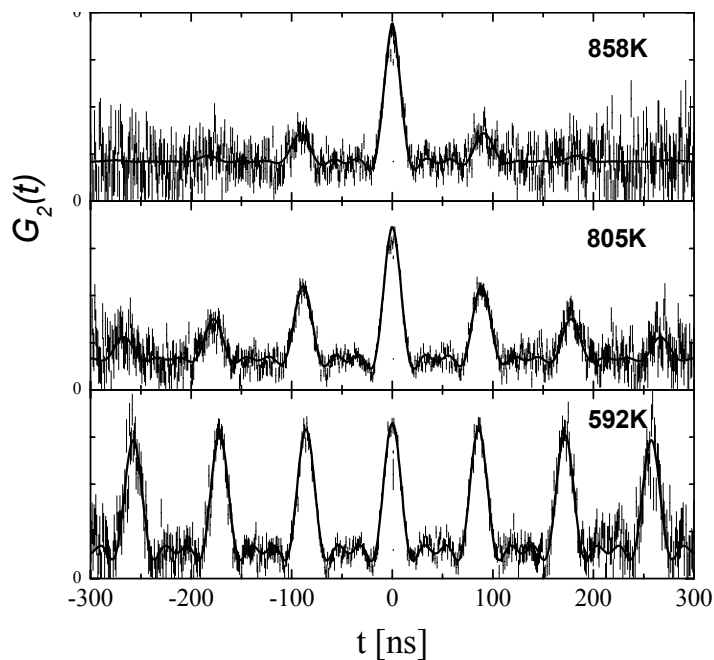
# Diffusion in rare-earth intermetallics studied using PAC

Gary S. Collins, Washington State University, DMR 05-04843

**Background** We are using perturbed angular correlation of gamma rays (PAC) to measure **jump frequencies of cadmium tracer atoms** in an extensive set of rare-earth intermetallics, stannides and gallides having the  $L1_2$ , or  $Cu_3Au$ , structure (see diagram with arrows showing jumps). The jumps are caused by passage of vacancies that reorient the local electric field gradient and lead to decoherence of nuclear spin precessions (see damping in spectra below). The jump frequency  $\omega$  is the inverse of the damping time.



**Results** An Arrhenius plot of fitted values of  $\omega$  is shown below for several systems. The fits give activation energies in the range 0.86-1.04 eV and jump frequency prefactors of 1-20 THz.



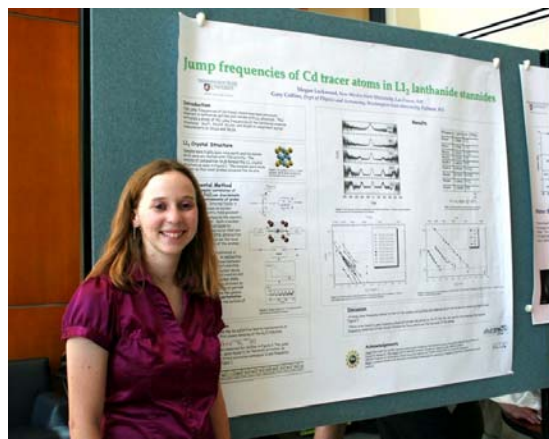
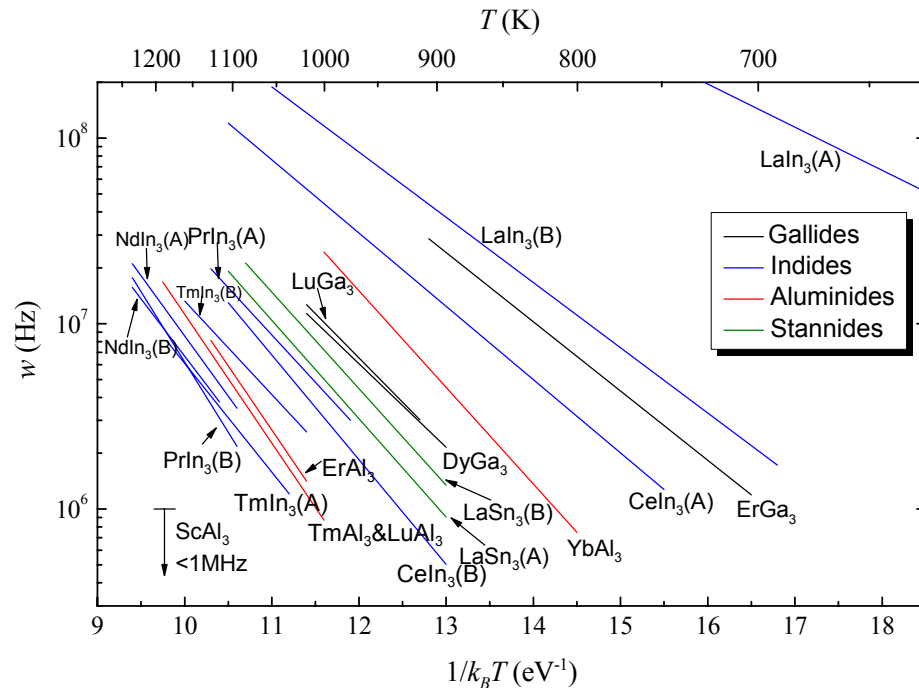
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**More Results** are summarized at right. There is an enormous range of jump frequencies in these systems.

**Significance** The jump frequency is proportional to the diffusivity, but the measurements are much less laborious. A good measurement takes a day and many measurements can be made on the same sample. We are currently identifying underlying diffusion mechanisms through systematics of the measured jump-frequencies.

**Other Impacts** Students contributing to this research include three graduate, two undergraduate and one high-school student, shown in photos from summer 2008.



*On the right:* Randy Newhouse, Ben Norman, John Bevington, Justin Ahn, Xia Jiang and myself.

*On the left:* Megan Lockwood, an REU summer school participant.

