



Experiment title: A Eu-151 INS study of the phonon density of states and Eu jump diffusion in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$

Experiment number:
HS-2394

Beamline:
ID22N

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Shifts:
18

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Received at ESRF:

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Report:

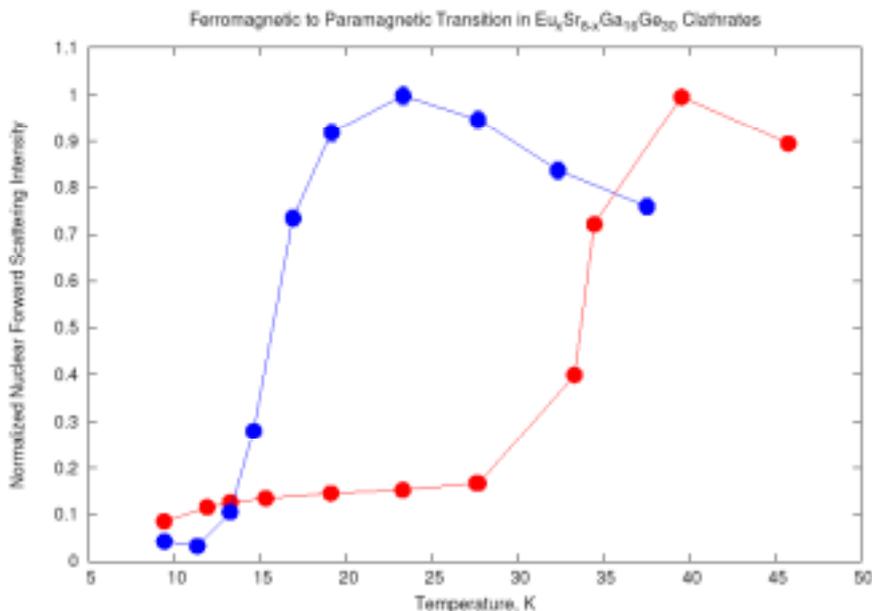


Figure 1: The ferromagnetic to paramagnetic transition in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$, red, and $\text{Eu}_4\text{Sr}_4\text{Ga}_{16}\text{Ge}_{30}$, blue, as detected in the temperature dependence of the nuclear forward scattering intensity.

A drastic increase in the nuclear forward scattering intensity at 35 and 15 K accompanies the ferromagnetic to paramagnetic transition.

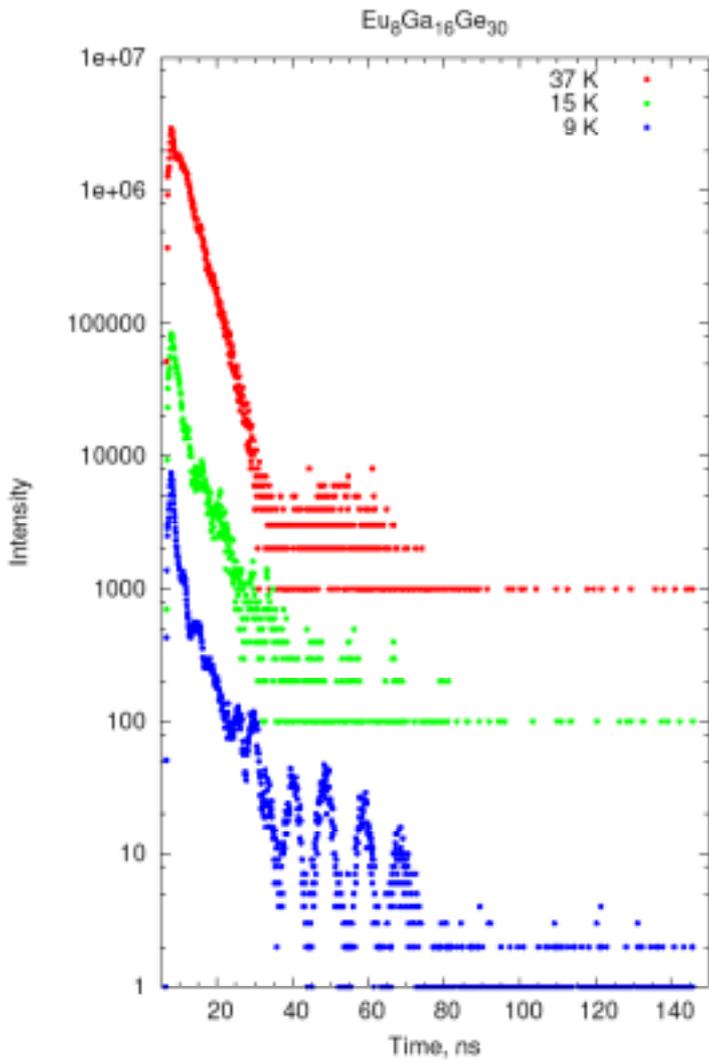


Figure 2: The nuclear forward scattering in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$ at 9, 15, and 37 K.

At 9 K, $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$ is magnetically ordered. The minority Eu site experiences a static hyperfine field, which produces the intense beats observed between 30 and 80 ns. The majority Eu site experiences a fluctuating hyperfine field, which produces the fast decrease with time of the intensity observed below 30 ns. At 15 K, some of the beats are still visible and at 37 K above the magnetic ordering temperature, they have disappeared.

The vibrational density of states of Eu in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$ has been determined at 10 K and is shown in Figure 3. The two Eu sites are not resolved at an energy resolution of 1.6 meV. The fit with two Gaussian peaks gives energies of 3 and 7 meV for the local vibrational modes of the Eu(B) and Eu(A) sites, respectively. The Eu(B) energy is in good agreement with the value obtained from heat capacity and Raman scattering measurements. The Eu(A) energy is measured for the first time.

Figure 3. The europium-151 partial density of states in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$. The solid line is the result of a fit with two Gaussian peaks, dashed lines.

