ESRF	**Experiment title:** Development of ^{119}Sn nuclear resonant scattering and first application to highly correlated electron systems	**Experiment number:** HE-282
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Report:

In the following we report on the first sucessful nuclear scattering experiments at the 23.8795 keV resonance of ^{119}Sn using both Nuclear Forward Scattering (NFS) and Nuclear Inelastic Scattering (INS) performed by us at ESRF (ID18); 29 shifts in multi-bunch mode and 9 shifts in 16 bund mode. For the high energy resolution monochromator (HRM) we have chosen for the outer channel cut crystal Si(6 4 2) reflection (asymmetric) and symmetric Si(12 12 12) for the inner channel cut crystal. Fig. l(a) demonstrates the excellent resolution: the energy bandpass of the monochromator was 0.97(5) meV (FWHM), which corresponds to the relative energy resolution $\Delta E/E = 4 \cdot 10^{-8}$. This energy resolution is much higher than that reported, e.g. by the Argon group (- 3 meV). The time resolution of the detector was about 1.4 ns. Typical count rate at resonance was $\sim$ 3.5 counts per second (cps) for NFS, at ambient pressure, 6 cps for INS and about 0.3 cps for high pressure NFS test experiments in a Diamond Anvil Cell (DAC).
In Fig. l(b) we show first NIS measurements on an enriched (90 % ^{119}Sn) β-Sn foil ($\sim 8\ \mu m$) which clearly show the low energy acustic phonon around 3.5 meV, in an agreement with both inelastic neutron experiments and theoretical prediction. In Fig. 2, 3 and 4 we show collected NFS spectra at 300 K, on simple materials β-Sn and SnS which display no magnetic order. The analysis of the spectra clearly reveals the expected hyperfine interactions in these materials.
Most interesting are measurements on UNiSn in the magnetically ordered state (T = 4.2 K) at ambient pressure and at 10 GPa in a DAC. In both cases one observes at Sn a transferred hyperfine field (B_{thf}), which originates from the ordering of the U 5f-magnetic moments. Dispite the poor statistics (count rate $\leq$ 0.3 cps) one can resolve $B_{thf} \approx$ 7 T at ambient pressure which is in agreement with that known from conventional ^{119}Sn Mössbauer measurements. At 10 GPa B_{thf} increases to $\sim$ 10 T, indicating the stable moment behavior of U 5f moments in this pressure range.

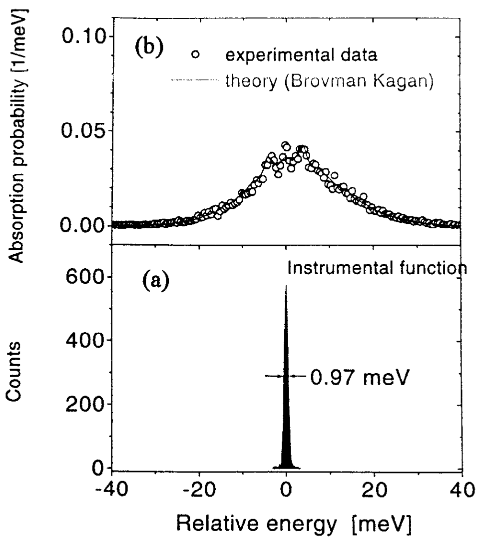

Fig.1 : (a) NFS scattering at resonance; the width of the peak gives the energy resolution of the setup; (b) Inelastic Scattering on β-Sn foil as a function of energy

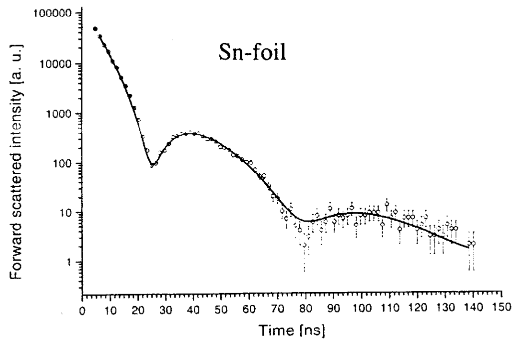

Fig.2 : NFS spectrum of β-Sn at 300 K. The solid line is a fit to the spectrum according to the dynamical theory of NFS

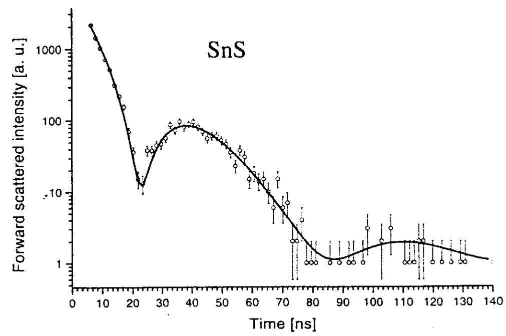

Fig:3 : NFs spectrum of SnS at 300 K

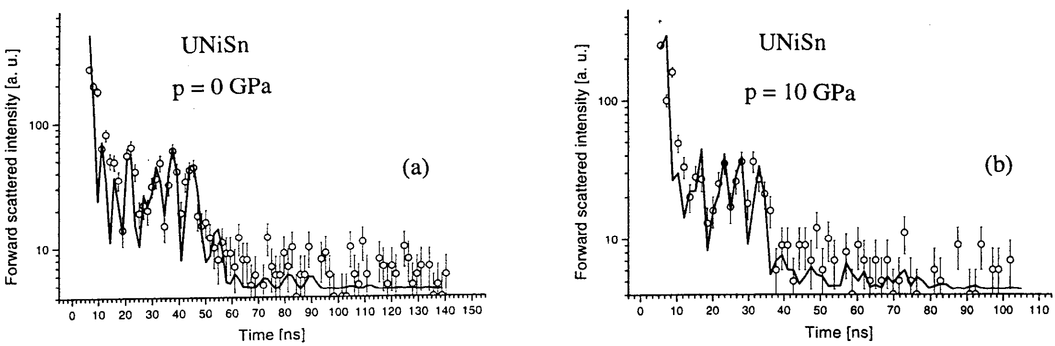

Fig.4 : NFS spectrum of UNiSn in the magnetically ordered state (4.2 K) at ambient pressure (a) and 10 GPa (b). Solid lines are fits adopting the dynamical theory of NFS