



	<b>Experiment title:</b> Spintronic devices: low dimensional structures based on GaN:Mn	<b>Experiment number:</b> 30-02-718
<b>Beamline:</b> BM30B	<b>Date of experiment:</b> from: 12 March 2005 to: 15 March 2005	<b>Date of report:</b> October 2008
<b>Shifts:</b> 9	<b>Local contact(s):</b> Vivian NASSIF	<i>Received at ESRF:</i>
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### Report:

Our experiment on BM30B was very successful. We were able to record good quality spectra for these 10 samples (E695, E301B, E630C, E670, E681, E574, E710, E542A, Quantum wires, E718). Moreover, for half of them, we had time enough to record spectra with both in-plane and out-of-plane polarization: the goal was to check the difference between Mn inside wurtzite environment and inside cubic GaN. Indeed, as the wurtzite environment is not isotropic, a difference is expected between in-plane and out-of-plane polarization, whereas no difference is expected for the isotropic cubic environment. In our case, wurtzite GaN are grown with axis-c perpendicular to the surface: in-plane exafs should look like cubic GaN.

This is illustrated on figure 1 where is presented the EXAFS simulation simulation and experimental data for comparison. As expected, cubic and in-plane polarized wurtzite are hardly distinguishable one from another but a characteristic difference exists around  $k\#8$ : in the case of out-of-plane polarization, wurtzite produces a double oscillation while a single one will be found for cubic GaN. This is obvious on recorded E695 (5% Mn doping) spectra as illustrated on the right part of figure 1.

Surprisingly for us, an even more visible difference exists on the XANES part of the E695 as illustrated on figure 2. Therefore, we decide to concentrate a bit more on the XANES spectra and more specifically on the relative intensities of the double pre-edge peaks. And we found that this relative intensity depends on the quantity of Mn incorporated (1% to 5%) or on the way it is introduced, either during growth or by implantation. This is illustrated on figure 3. As a consequence, study of Mn:GaN was reorientated on the study of pre-edge peaks using circular dichroism techniques on another ESRF beamline.

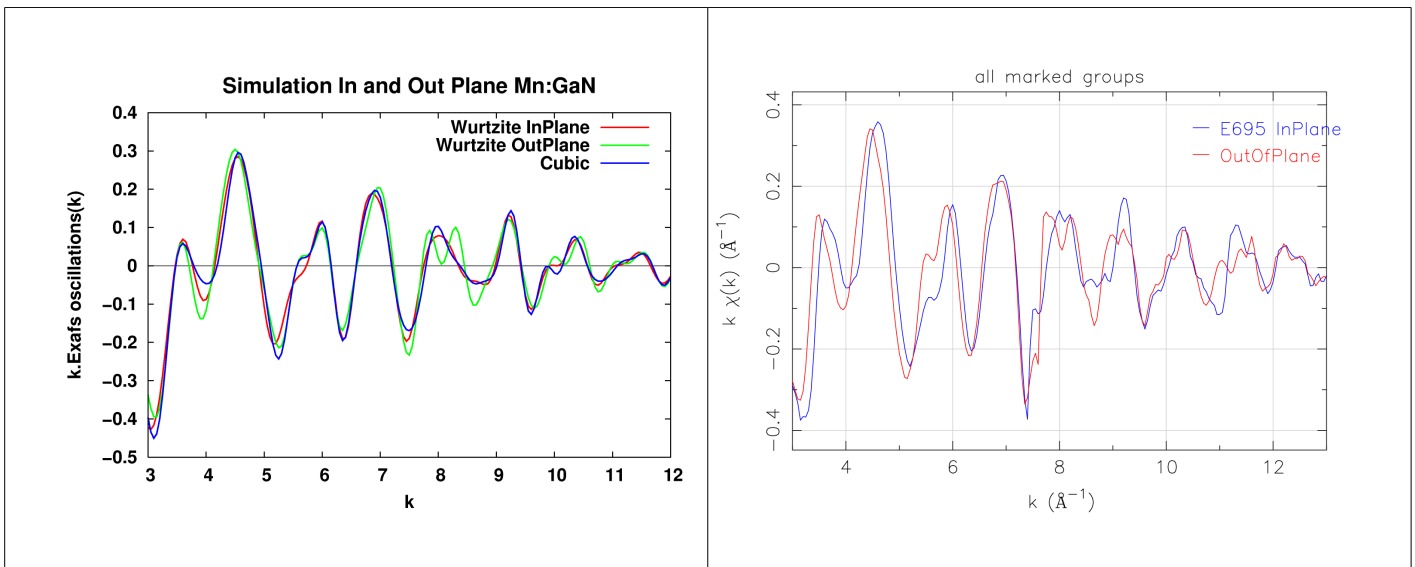


Figure 1: Left shows EXAFS oscillations simulation using FEFF. Right: experimental result on sample E695 showing the expected characteristic difference around  $k \approx 8$ .

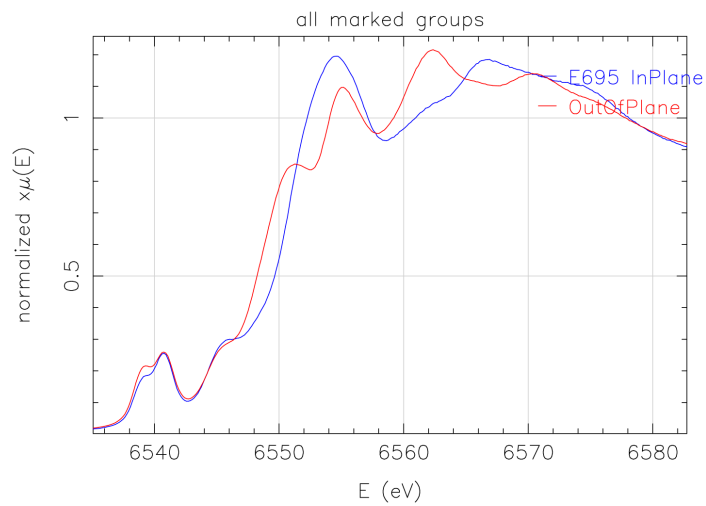


Figure 2: Sample E695: effect of polarisation on the XANES

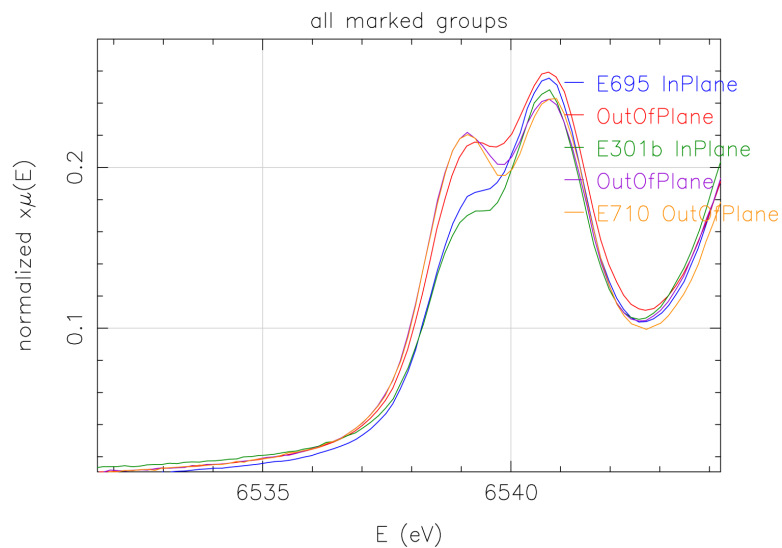


Figure 3: Anisotropic effect on the pre-edge double peaks.