

Further investigations of a defect-complex in III-nitride ternary semiconductors

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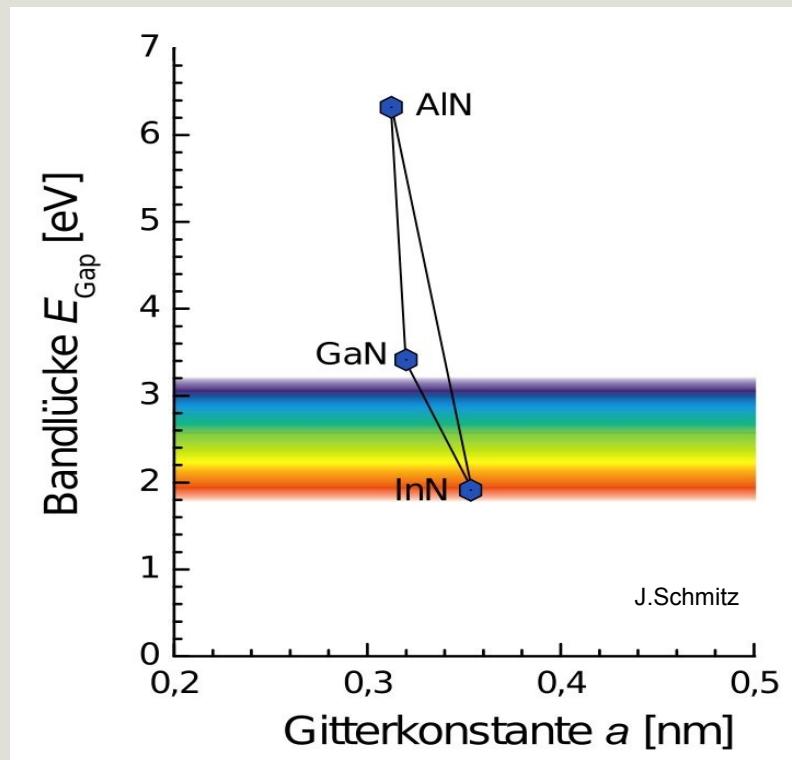
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Group III Nitrides

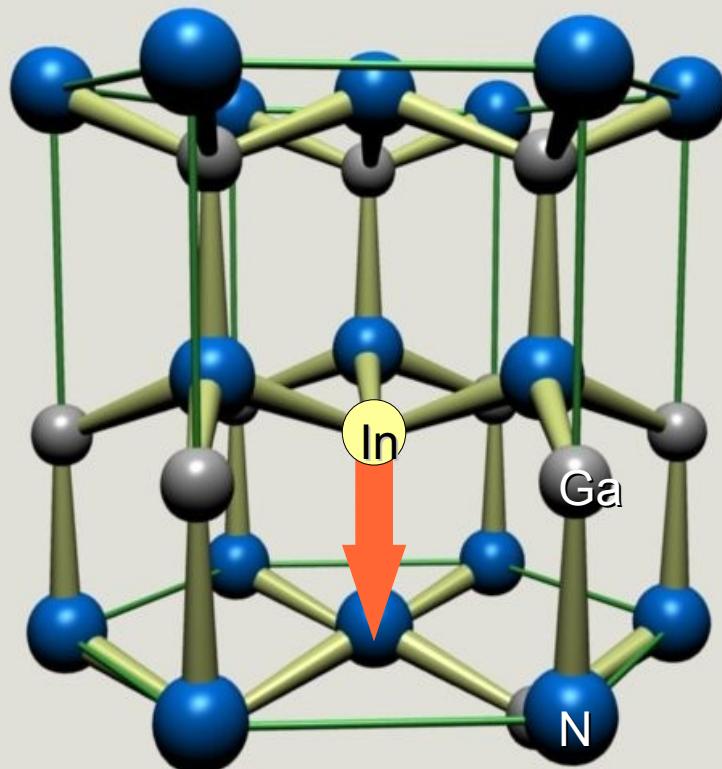


- AlN
- Bandgap 6.2 eV
- Wurtzite

- GaN
- Bandgap 3.4 eV
- High Luminous efficiency in spite of high defect concentration
- GaN luminescence mechanism not well understood
- Defect observed in AlN and GaN (possible explanation)
→ ***aim: more precise characterization***

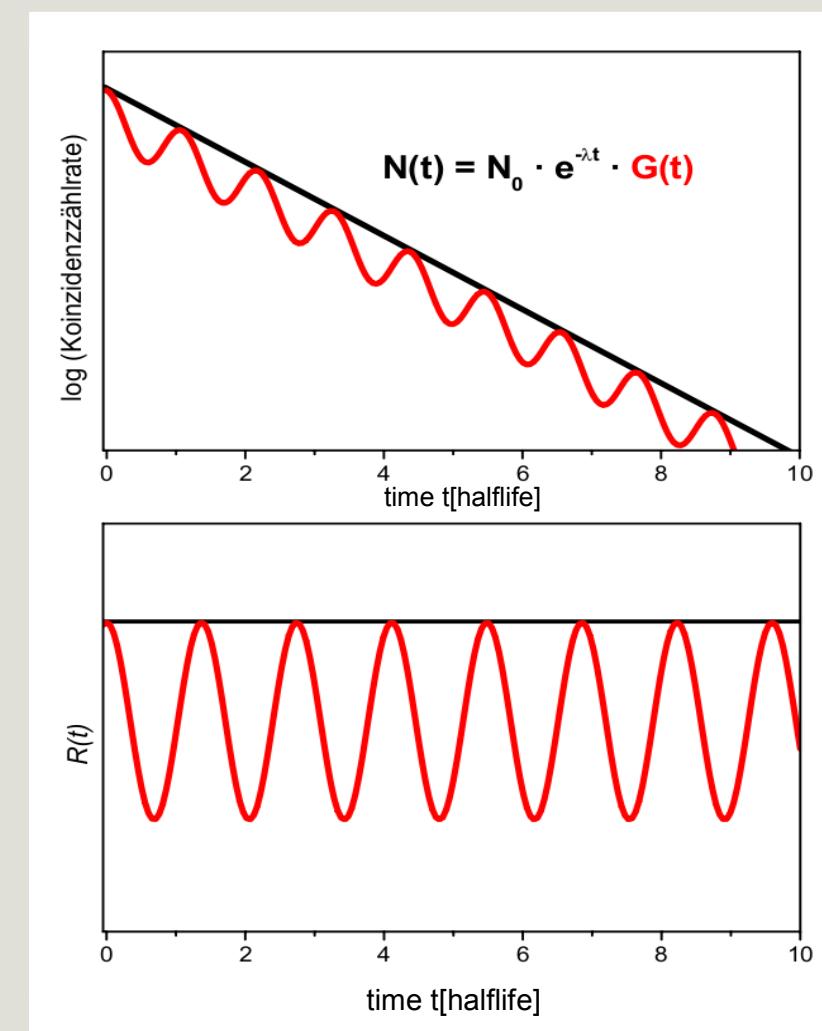
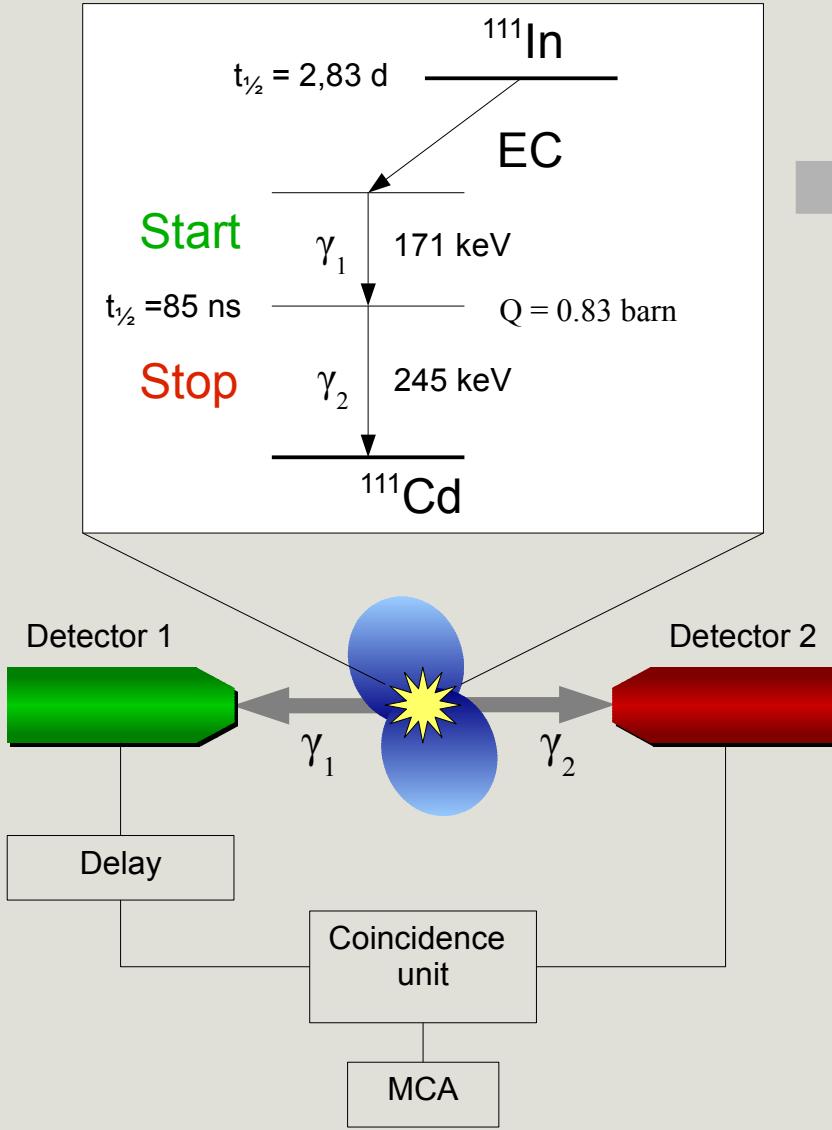
Electric field gradient (EFG)

Gan/ AlN



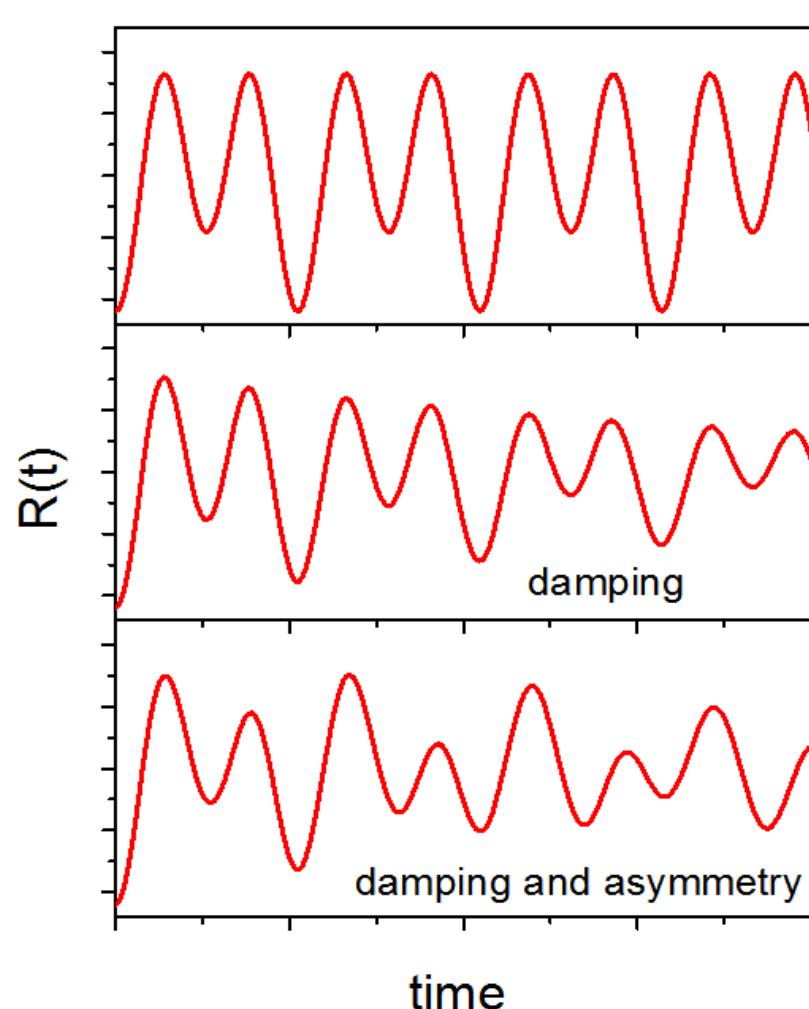
- Energy: 60 keV
- Dosis: ca. 10^{11} ions/cm²
- Deviation from cubic symmetry

Perturbed angular correlation (PAC)



$$R(t) = A_{22} G(t)$$

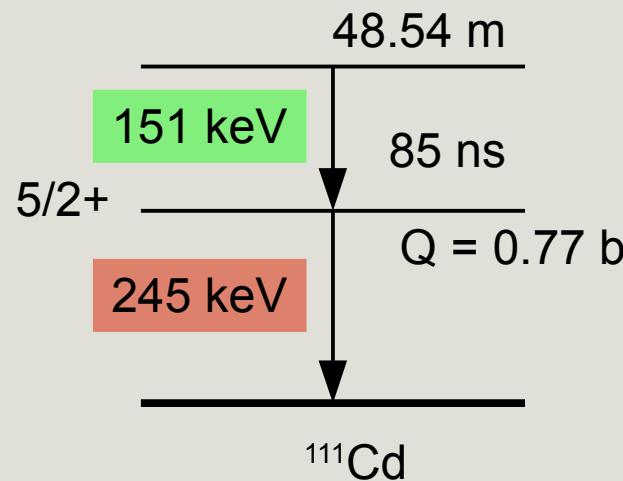
Perturbed angular correlation (PAC)



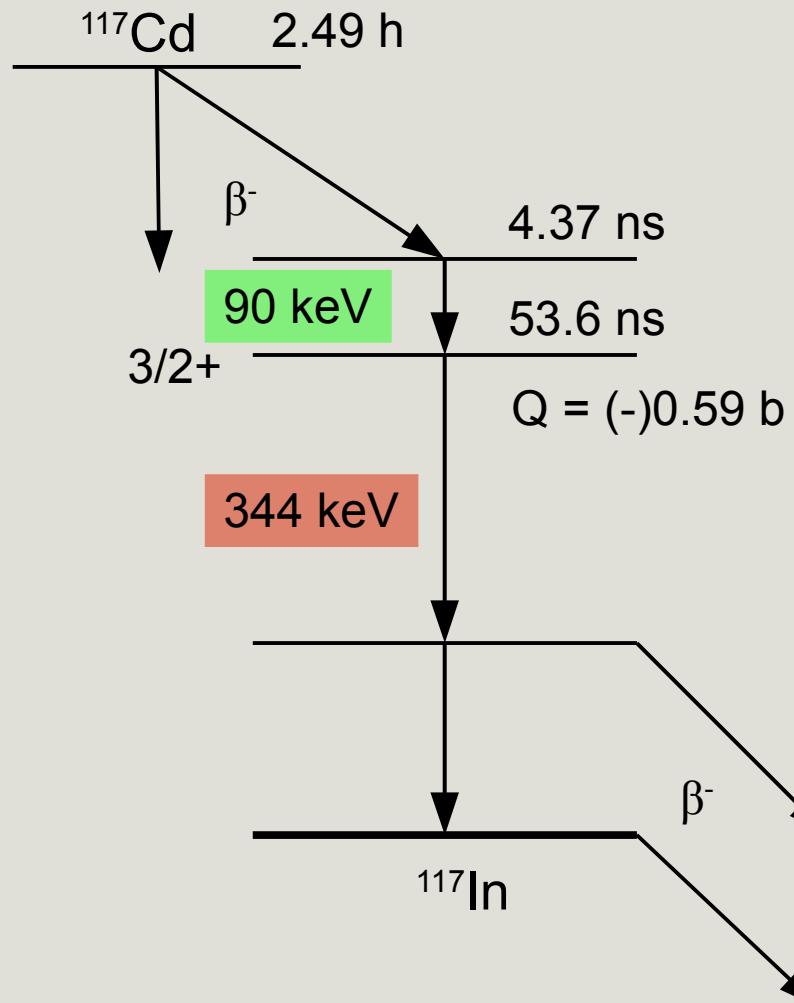
- v_Q : strength of interaction
- δ : uniformity of probe sites
- η : deviation from axial symmetry
- f : fraction of probes on corresponding site

Used Isotopes

^{111m}Cd

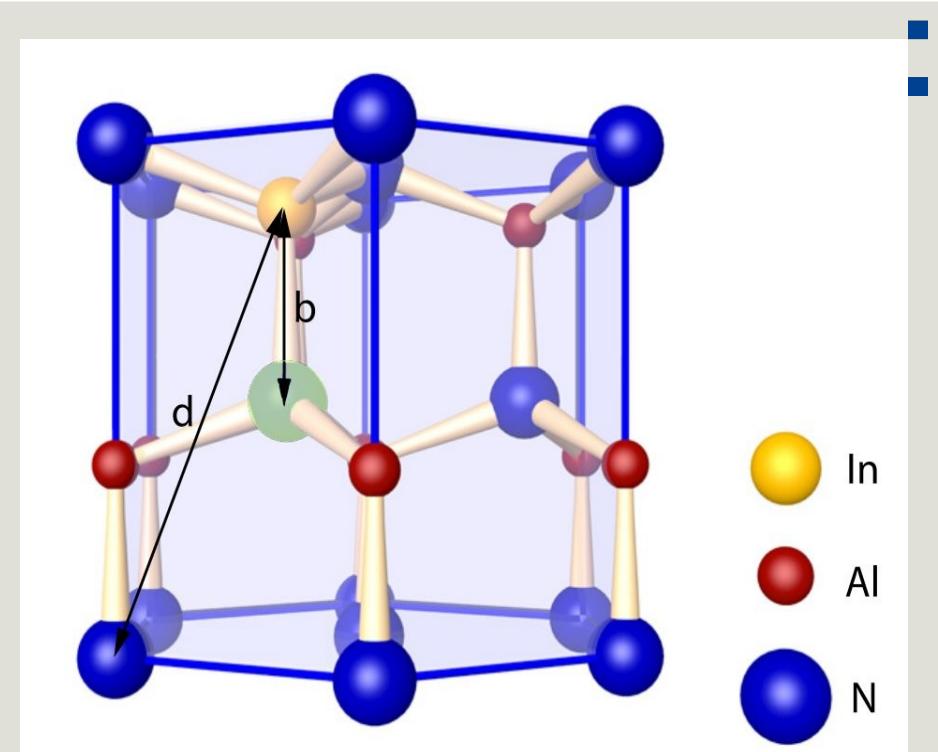
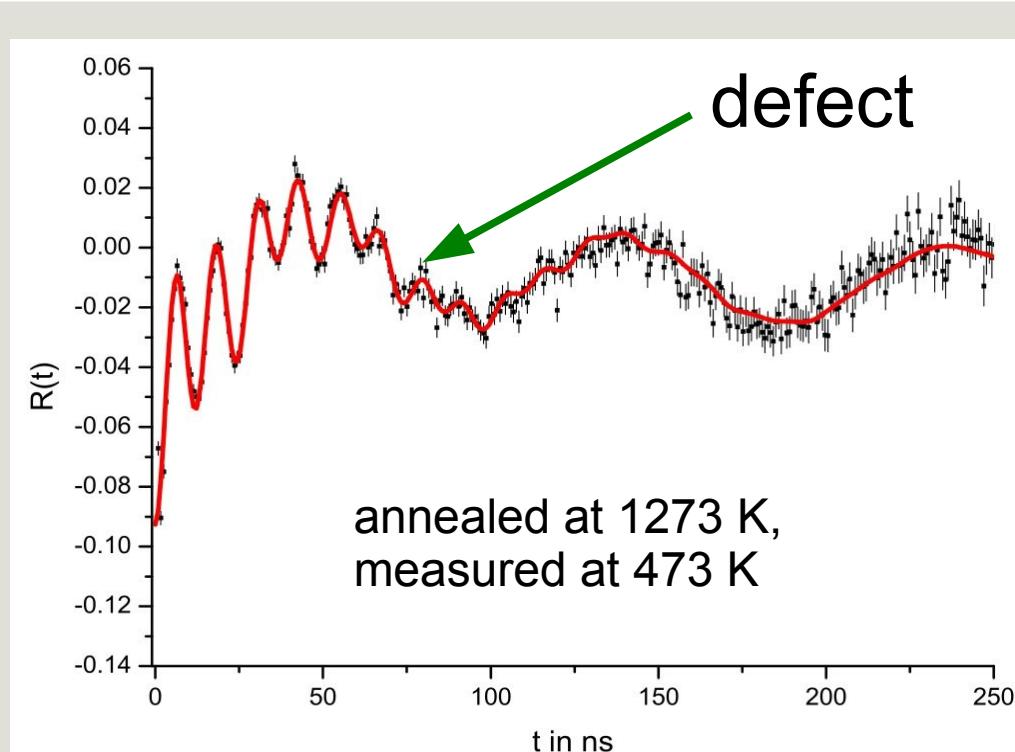


^{117}Cd



- Measurements at Indium and Cadmium probe
- Influence of the decay?

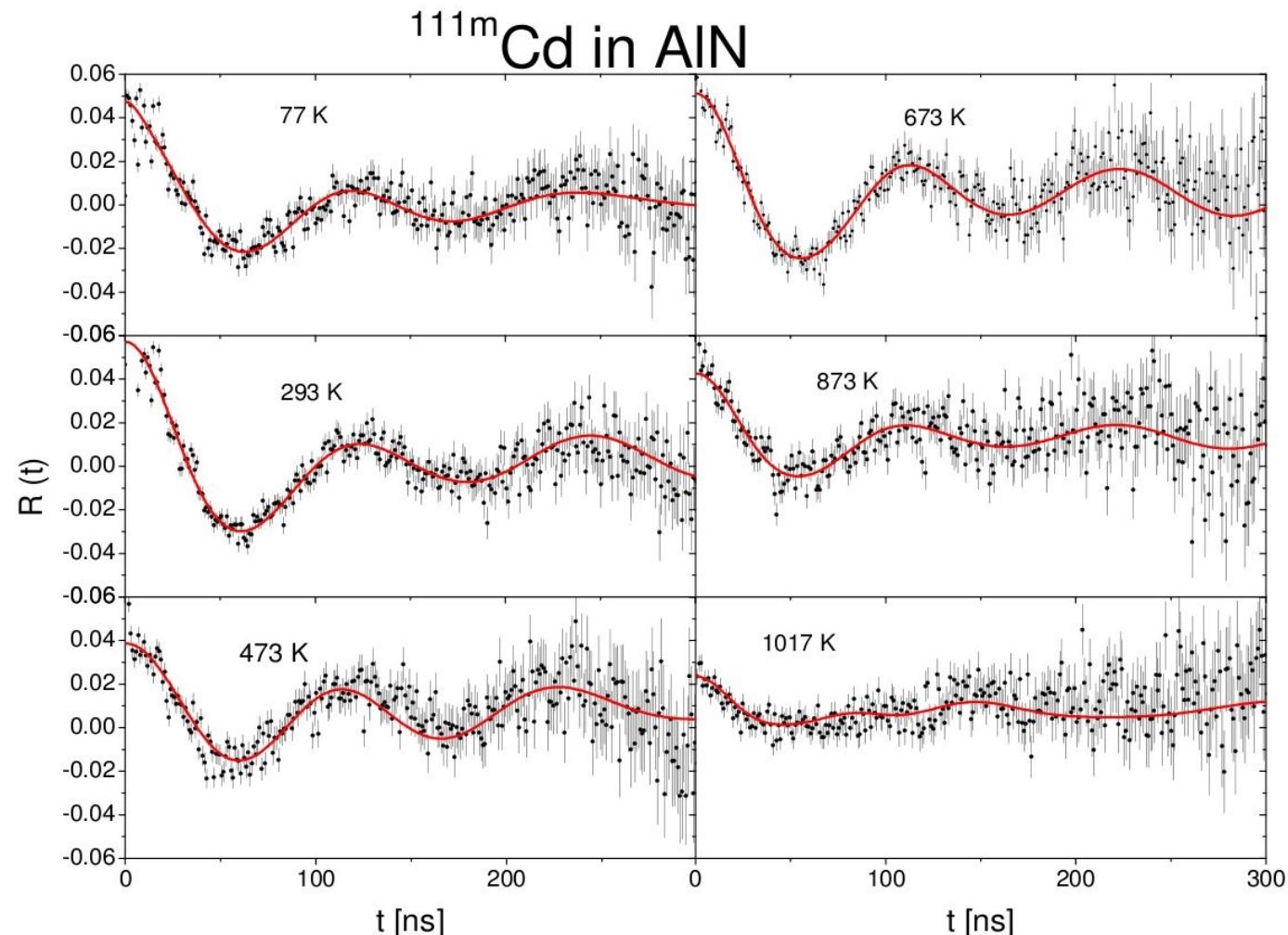
Previous Measurements: AlN



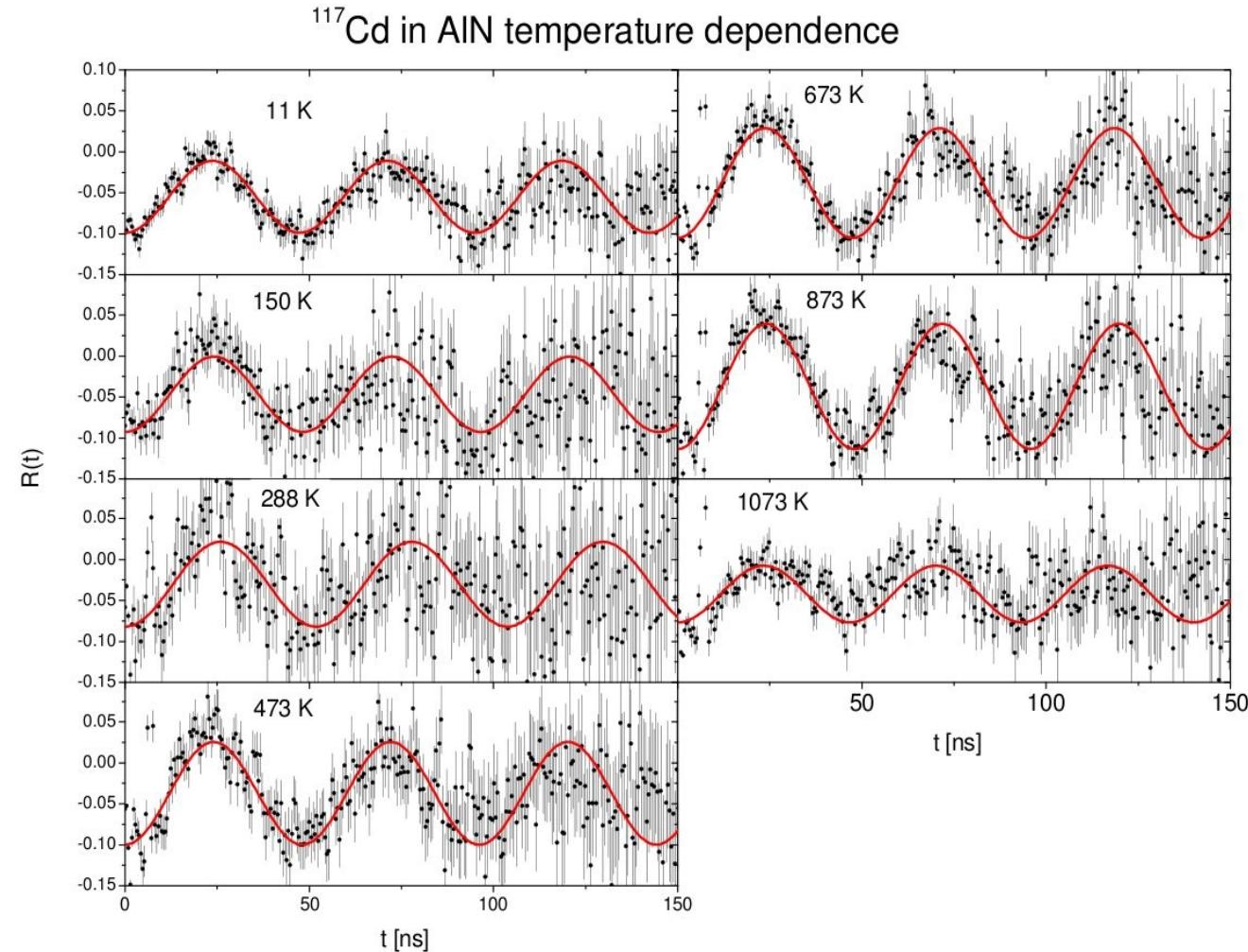
J. Schmitz, Diplomarbeit 2007: PAC-Untersuchungen an Gruppe-III-Nitridihalbleitern mit der Sonde ^{111}In

- Defect reversible
- Orientation along c-Axis
- In competition with stable ^{115}In
→ connects to Indium

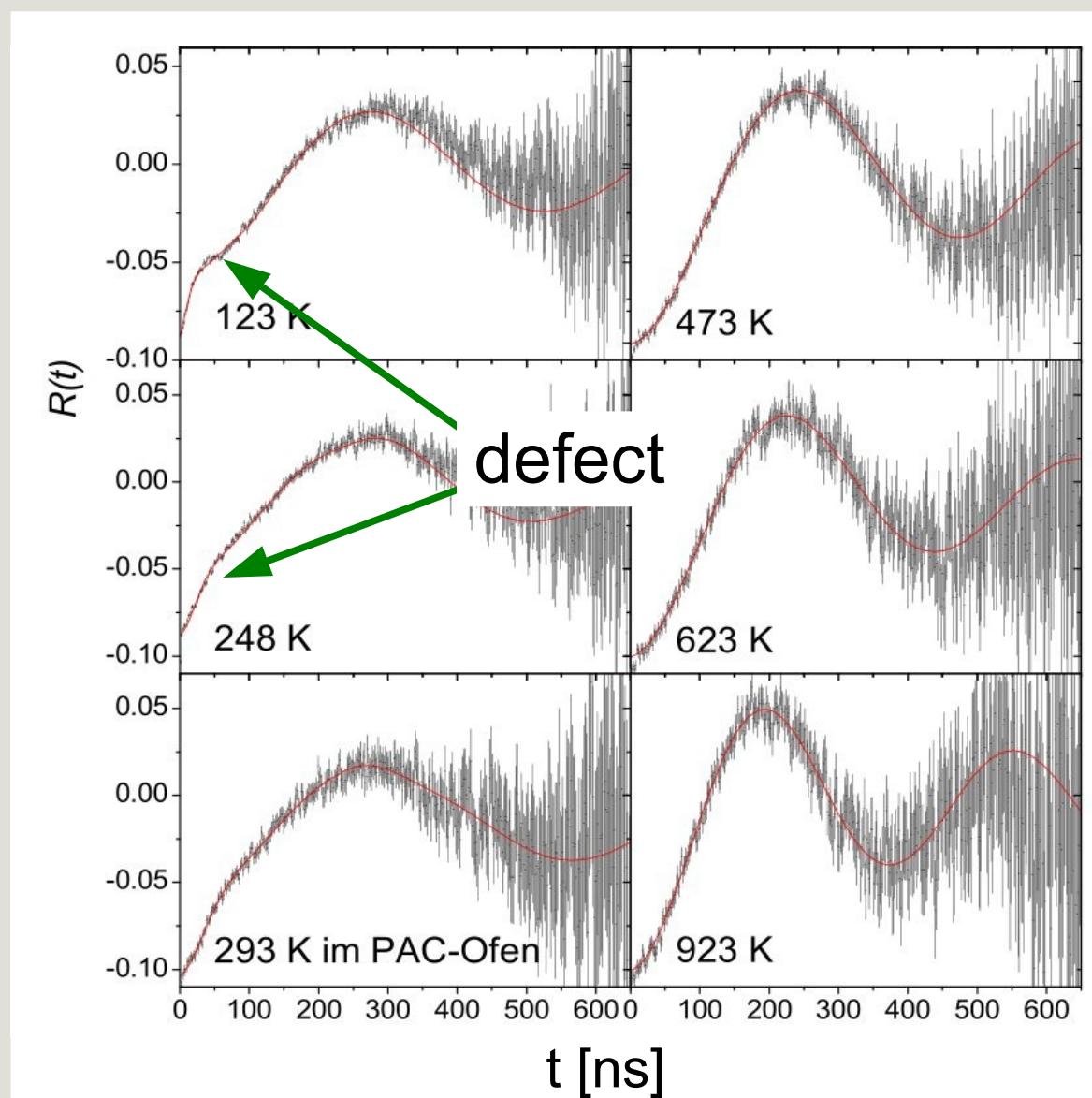
Measurements: AlN



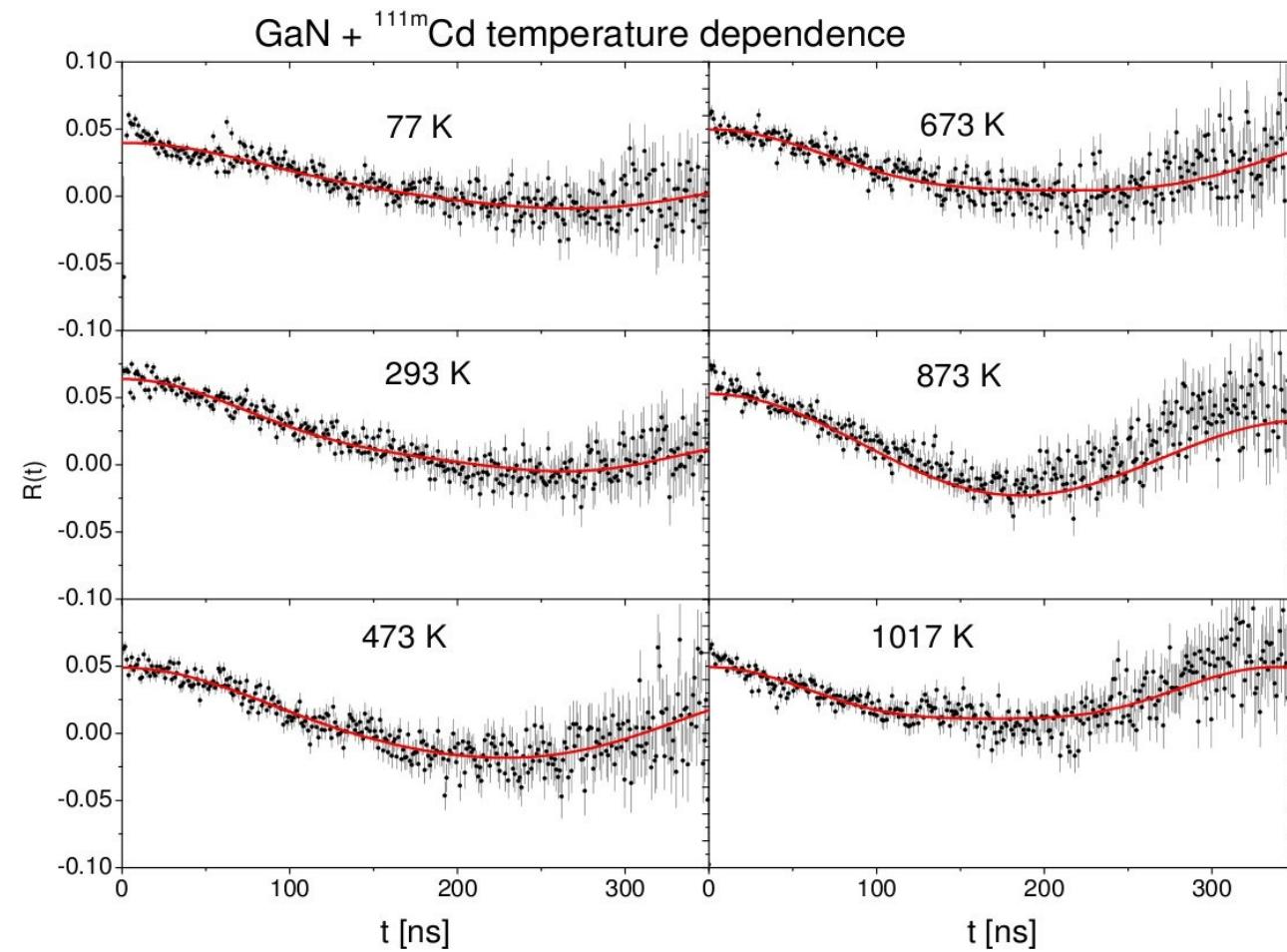
Measurements: AlN



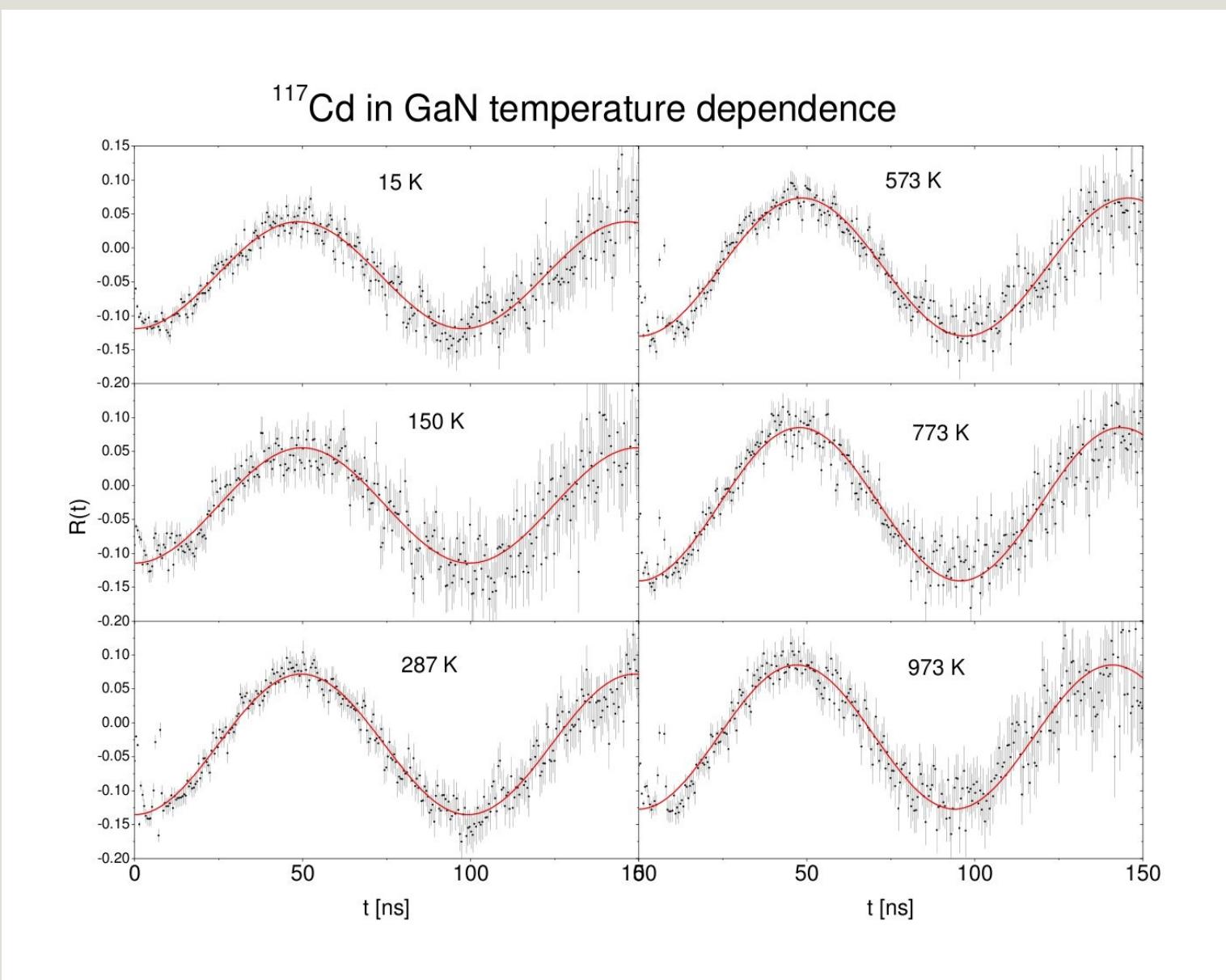
Previous Measurements: GaN



GaN Measurements



GaN Measurements



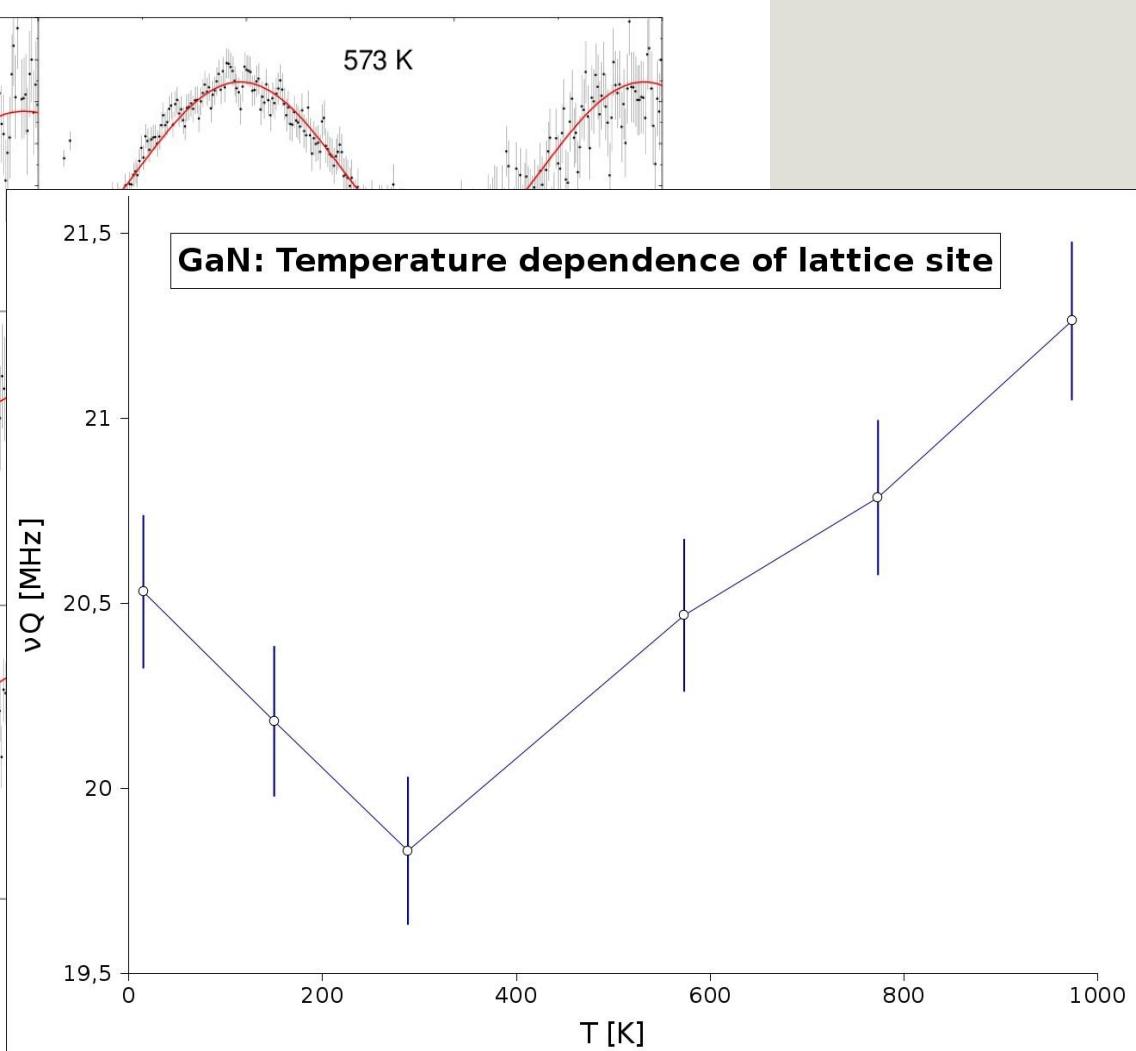
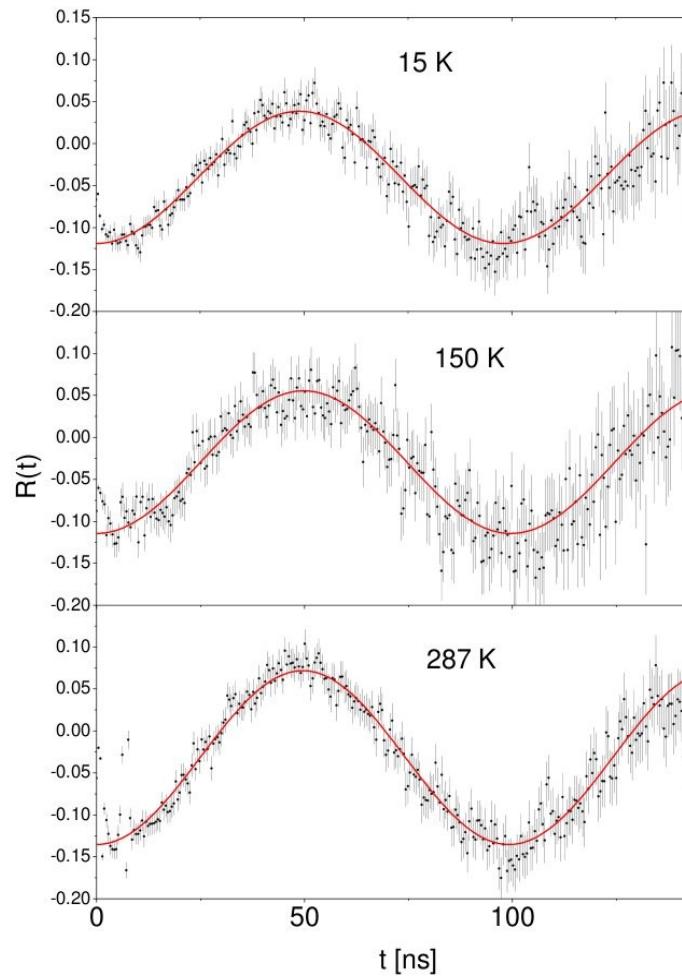
Results

- Measurements with new isotopes successful
- No defect visible with ^{117}Cd and $^{111\text{m}}\text{Cd}$ in GaN or AlN
 - Another hint for defect trapping of Indium
 - Consistent with previous measurements
- Problem: Sending radioactive samples to Bonn
- Outlook:
 - $\beta - \gamma$ measurements directly at CERN with ^{115}Cd

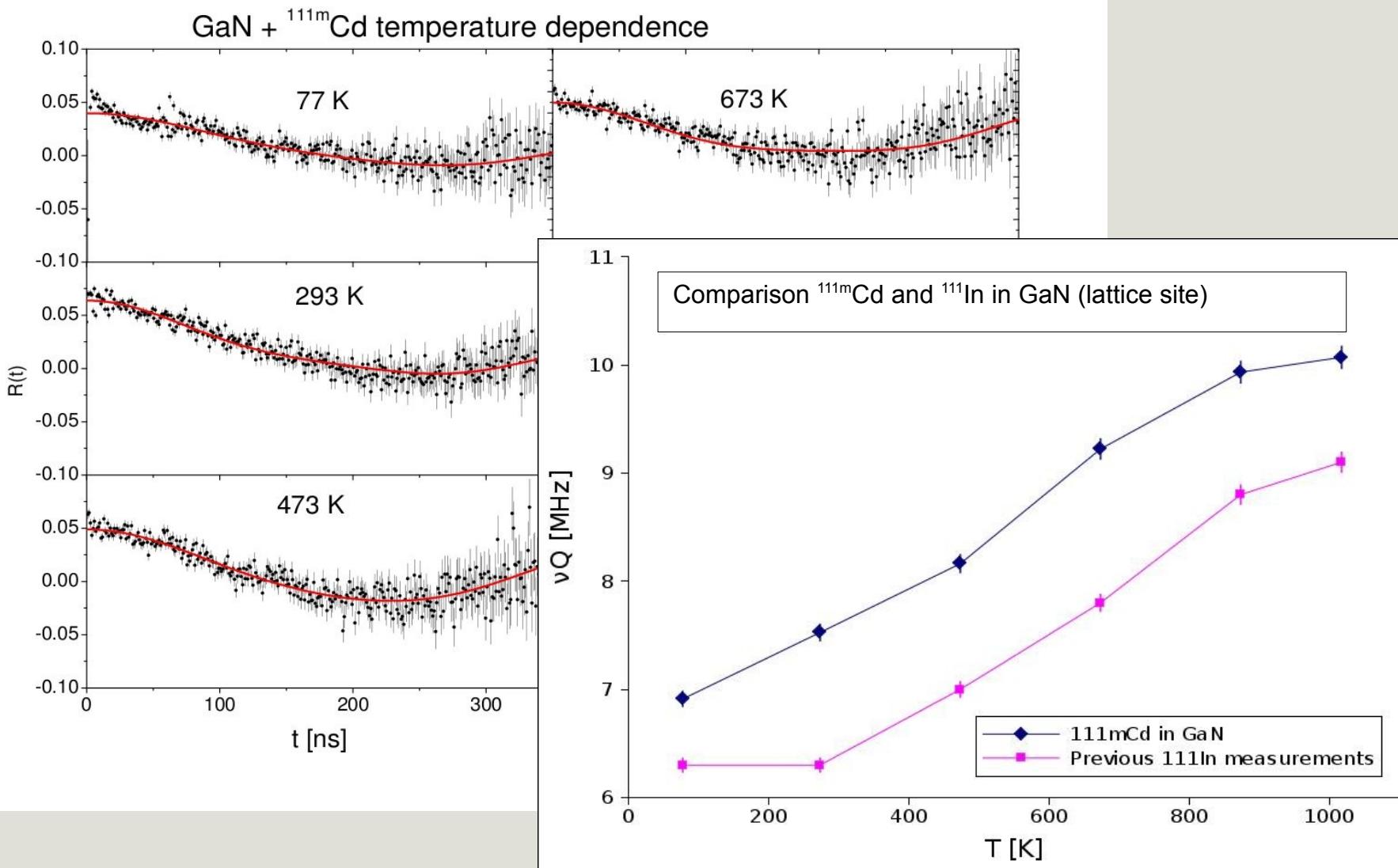
Thank you!

GaN Measurements

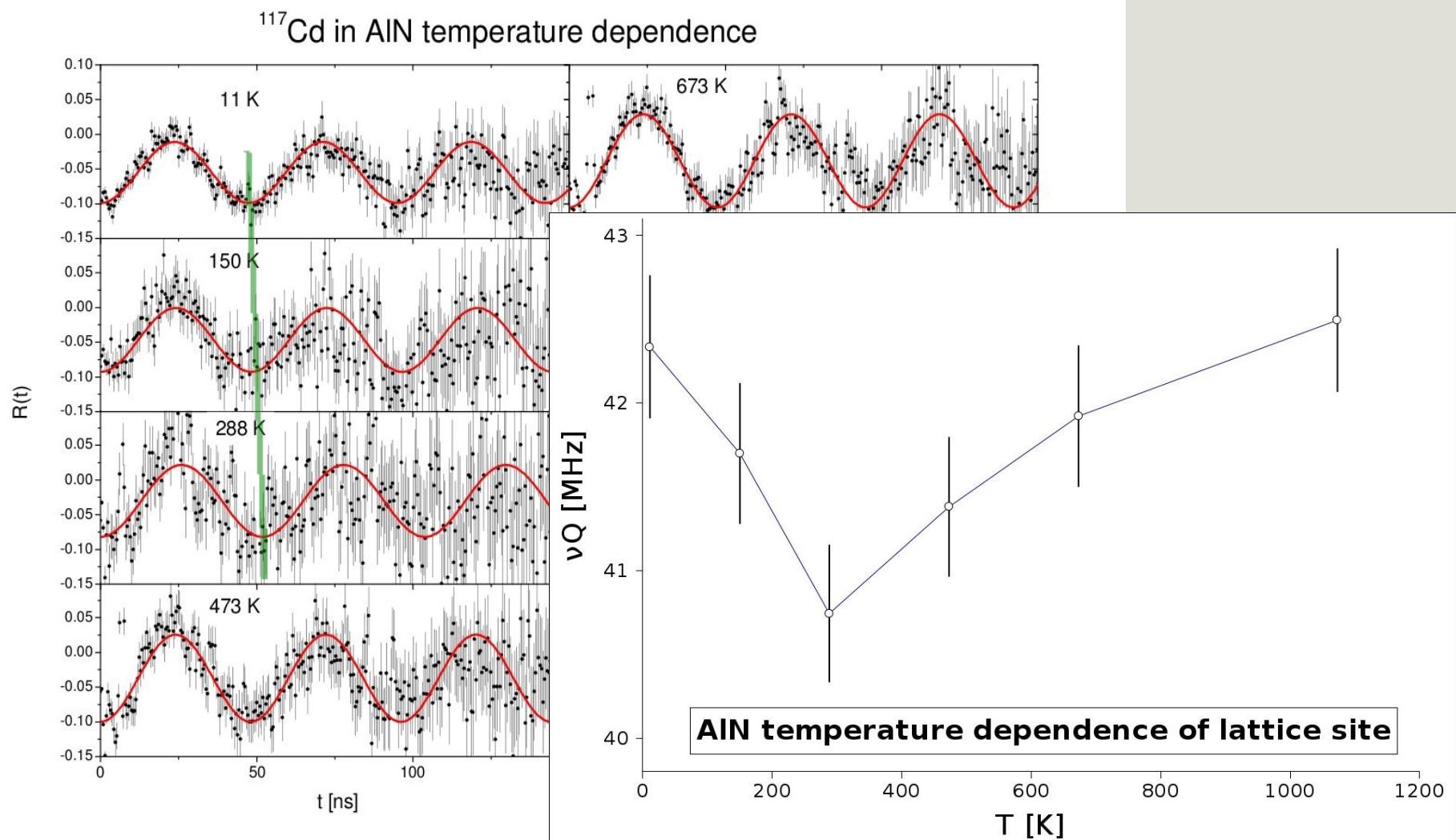
^{117}Cd in GaN temperature dependence



GaN Measurements



Measurements: AlN



Measurements: AlN

