Relaxation Time Adjustment for HD Dynamical Polarisation

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- Introduction
- Previous work (Solem)
- Proton relaxation (ageing)
- Electron relaxation
- Irradiation (setup + results)
- Summary

Introduction

- H-Atoms stably trapped in HD
- Proton Pol. of 3.75% (Solem)
- „brute-force“ target (Honig et.al.)
- Irradiation in Bochum: no Pol.
- Problem of nuclear relaxation
- Use pure material (ageing, Orsay)

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First dynamical Polarization

$$HD \longrightarrow \dot{D} + \dot{H}$$

- 10^{-4} radicals by bremsstrahlung

$$\dot{D} + H_2 \longrightarrow HD + \dot{H}$$

$$\dot{D} + HD \longrightarrow D_2 + \dot{H}$$

- H-atoms stably trapped
- D-atoms not

- Field: 1,24 T Temp.: 1,2 K
- Impurities: few **%** Oxygen: ~10^{-4}

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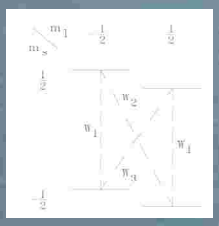
Solid State Effect

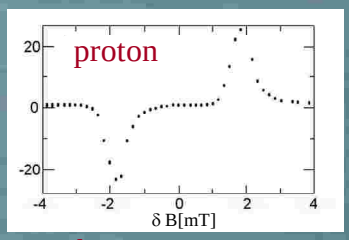


Valid in case of proton

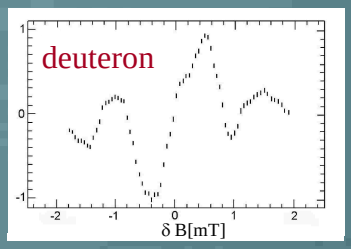
$$P = \frac{P_e}{1+f}$$

$$f = \frac{N}{n}\frac{T_1^e}{T_1^p}$$

max. T^p_1
min. T^e_1



Enhancement curves



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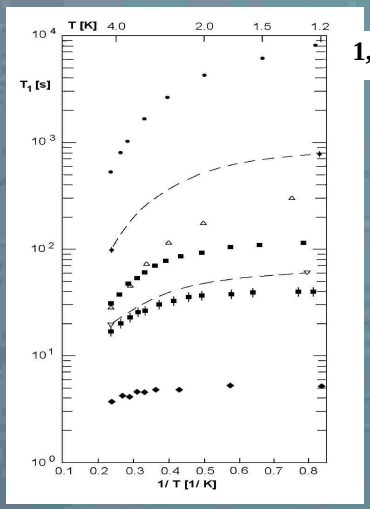
Proton spin relaxation



1,5· 10^{-5}

- Governed by ortho-hydrogen content
- Time dependent:

$$\frac{dc_0}{dt} = -Kc_0$$

- Process of ***ageing***

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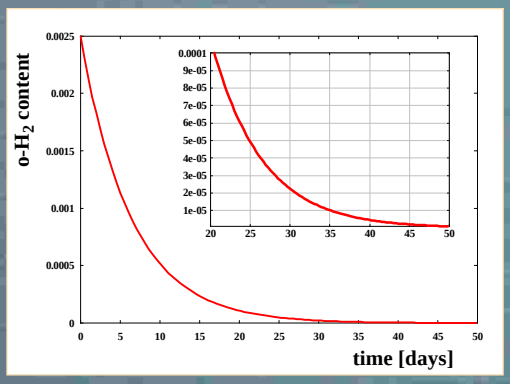
Ageing

H_2 conversion in HD



Accelerated relaxation due to irradiation !

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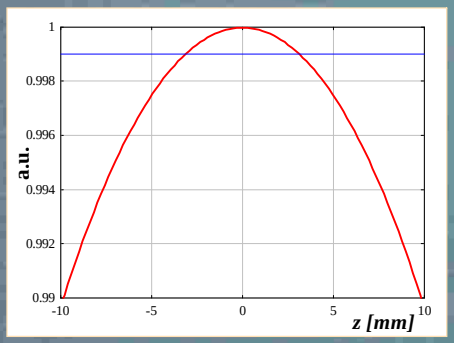
NMR monitoring

theoret. solenoid field



No signal found

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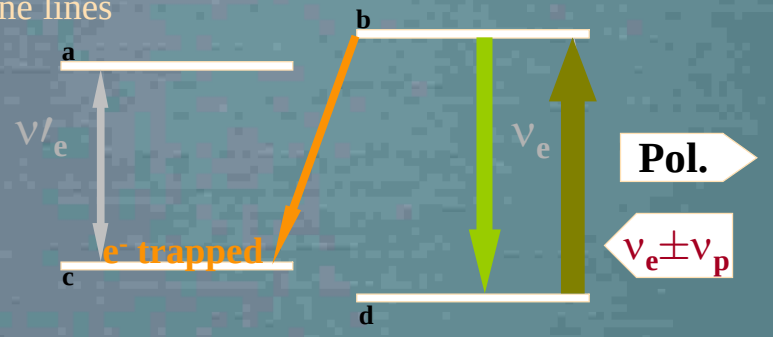
Electron relaxation

- f(impurities)
- 0,1s up to 1s
- with O_2: ~ ms

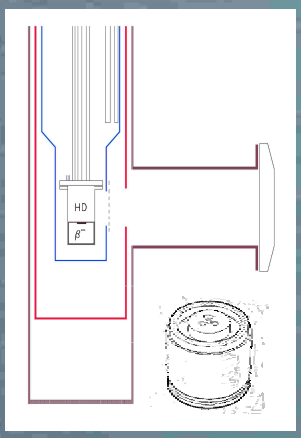
„Skew“ relaxation (A.,G.)

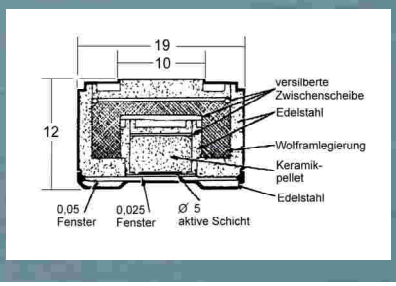
2 hyperfine lines



Release electrons by appropriate μ-wave irradiation

Irradiation

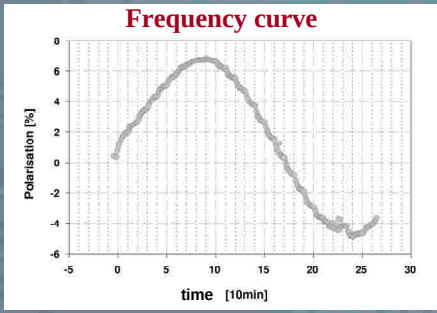




$^{90}Sr \xrightarrow[29\,y]{0.5\,MeV} {}^{90}Y \xrightarrow[2.7\,d]{2.3\,MeV} {}^{90}Zr$

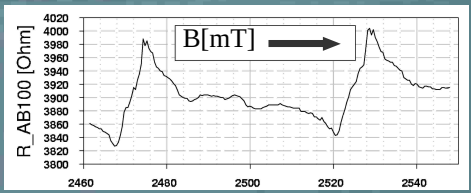
Activity: 100 mCu

Ability of β-source



butanol block
polarized ≈7%
3 weeks irrad.

bolometric
EPR-signal
in HD



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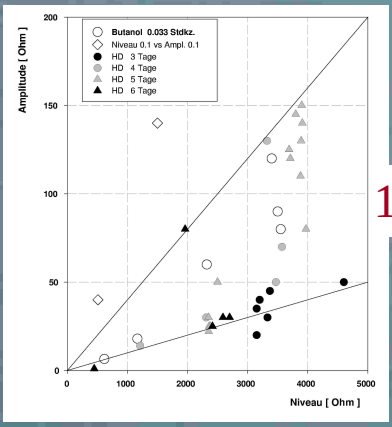
Density of paramagnetic centers



10^{-4}

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Summary

- conditions improved for new irradiation
- pure material
- consider skew relaxation
- add Oxygen??