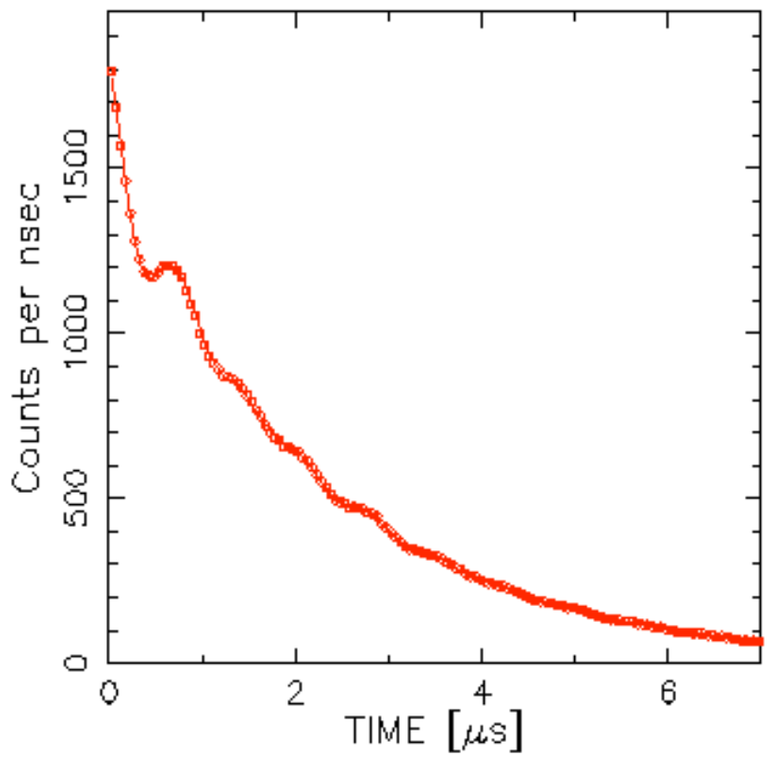
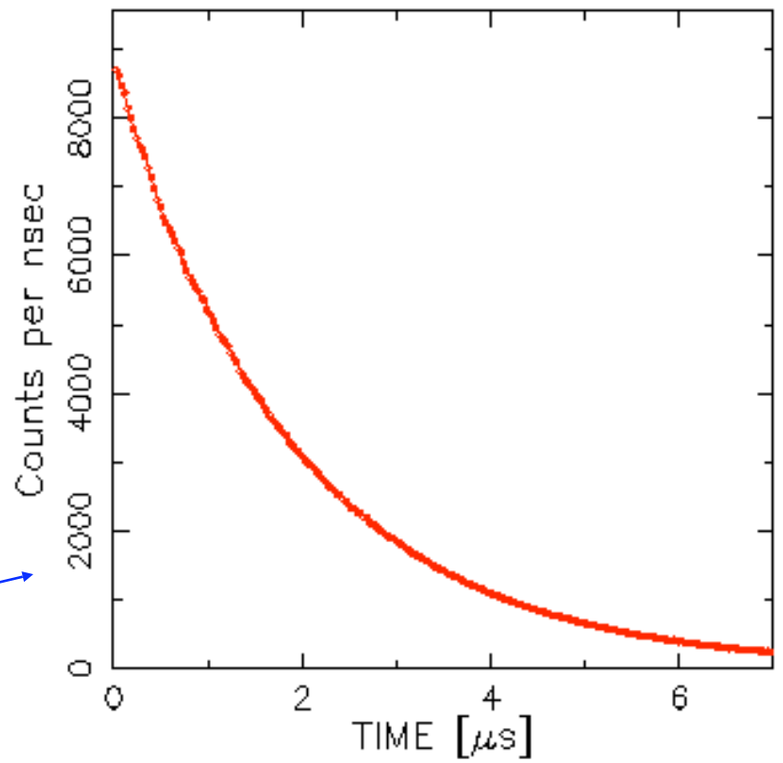
μ^+SR vs. μ^-SR

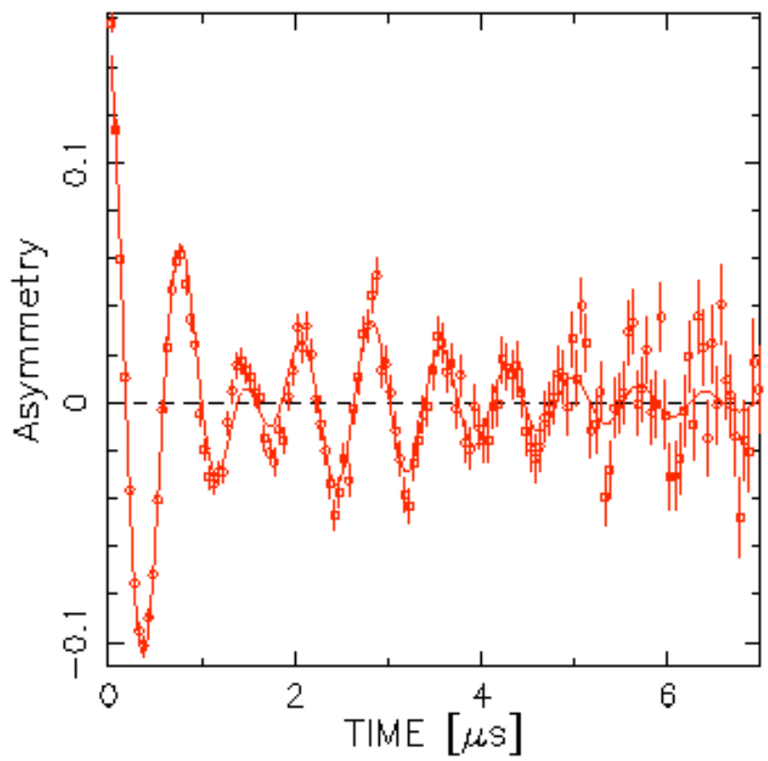


Typical time spectrum (histogram)

Single lifetime
τ_μ = 2.197 μs

Multiple lifetimes
(some very short!)

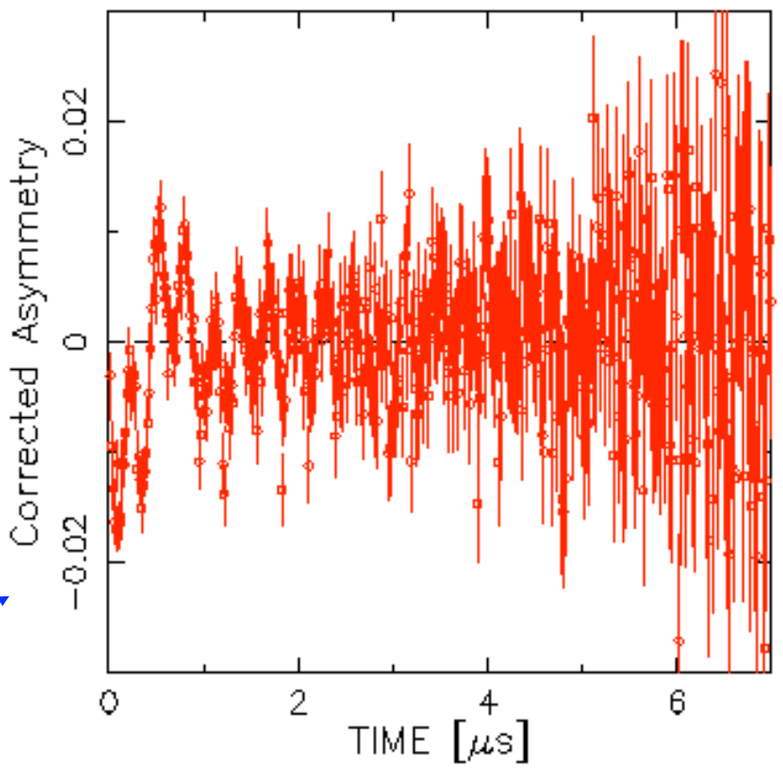




Asymmetry spectrum

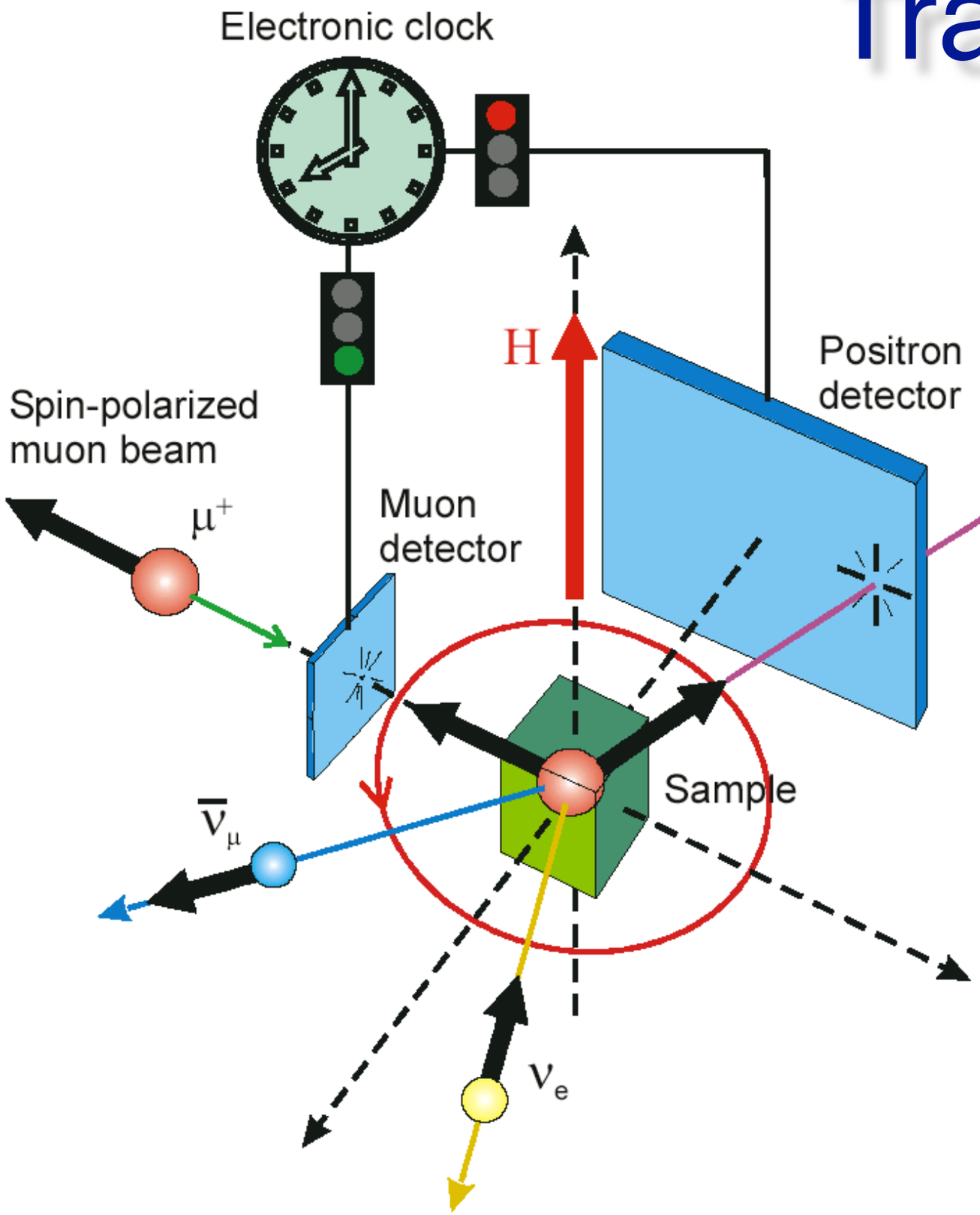
Large amplitudes

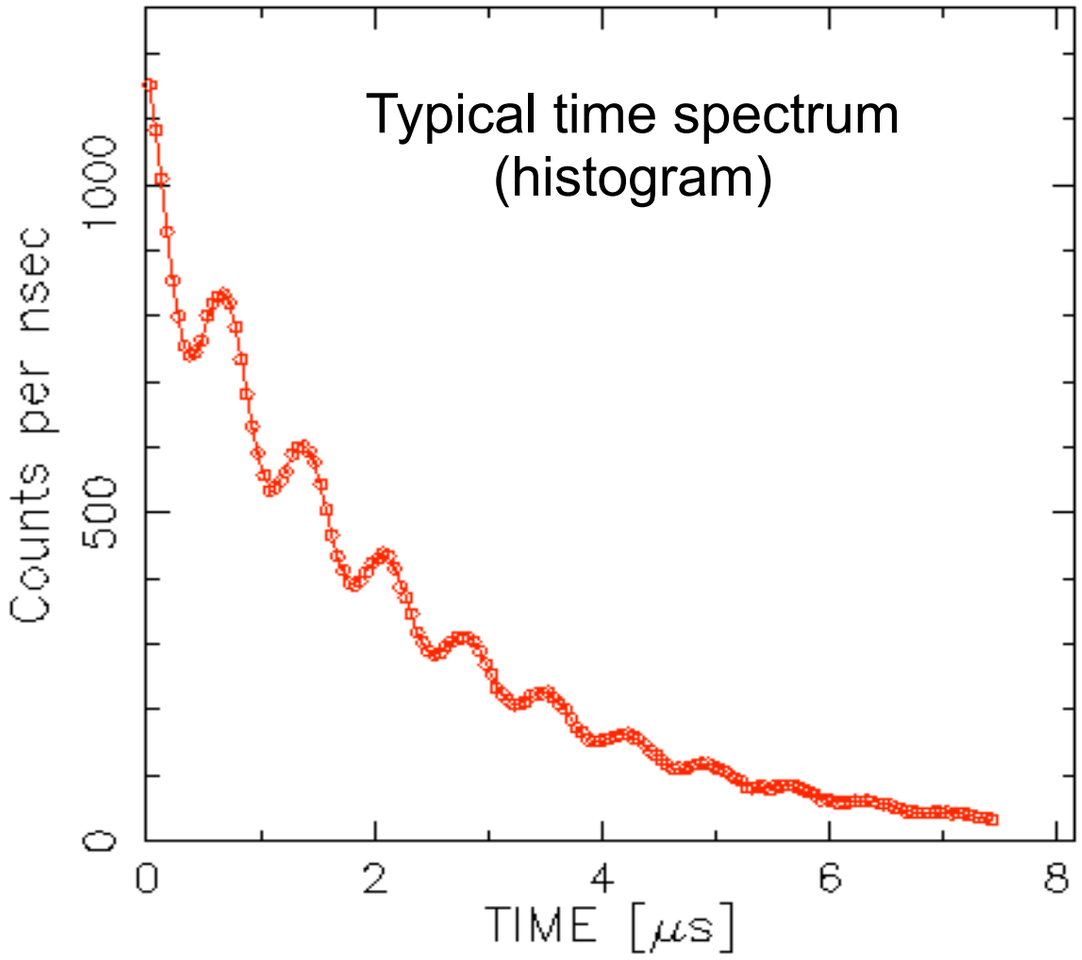
Small amplitudes



Transverse Field

(TF)-μ^+SR





μ^-SR : It is easy to get the impression that only positive muons are employed in μSR.

Although <u>most</u> μSR <u>is</u> μ^+SR, it is often desirable to use negative muons in the same way, albeit with more difficulty.

DRAWBACKS of μ^-SR

- **L•S** Depolarization in the atomic cascade
- Nuclear Muon Capture: short lifetimes, few decay e^-
- Giant Hyperfine Interaction with nonzero-spin nuclei

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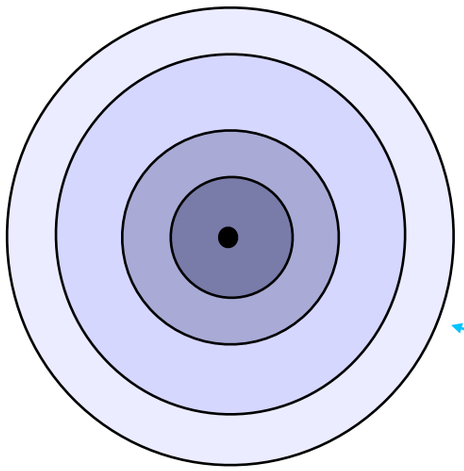
Atomic Capture & ***L·S*** Depolarization of μ^-

Large impact parameters are more probable

⇒ initial orbits tend to be **circular**.

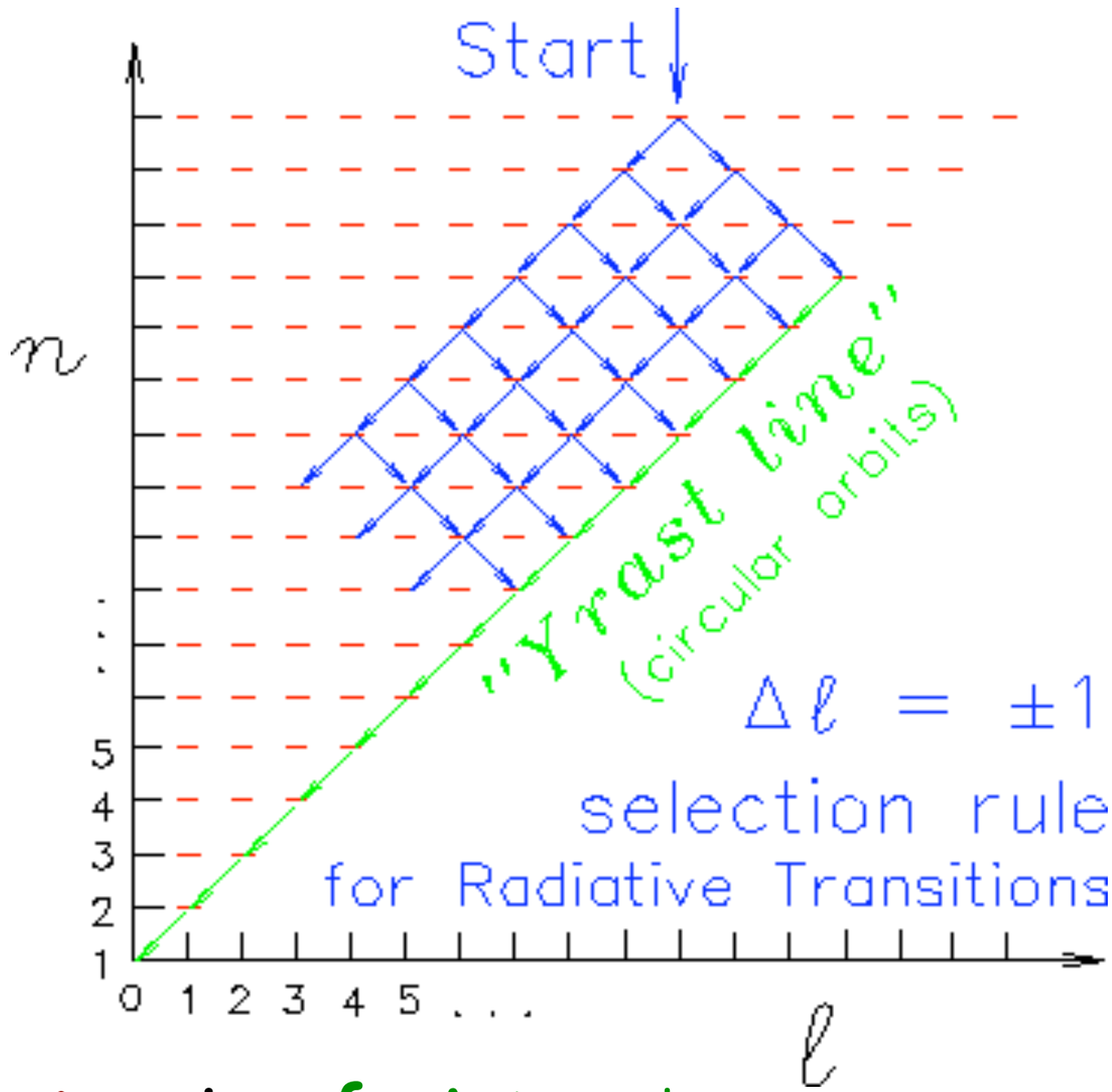


View along μ^- momentum

Primitive Atomic Physics:

$$r_n = \frac{a_\circ}{Z}\left(\frac{m_e}{m}\right) n^2$$

$$E_n = -\frac{13.6\ \text{eV}}{n^2}\, Z^2 \left(\frac{m}{m_e}\right)$$



L·S couplings **depolarize** μ^- **spin** **unless** **fast** Auger!

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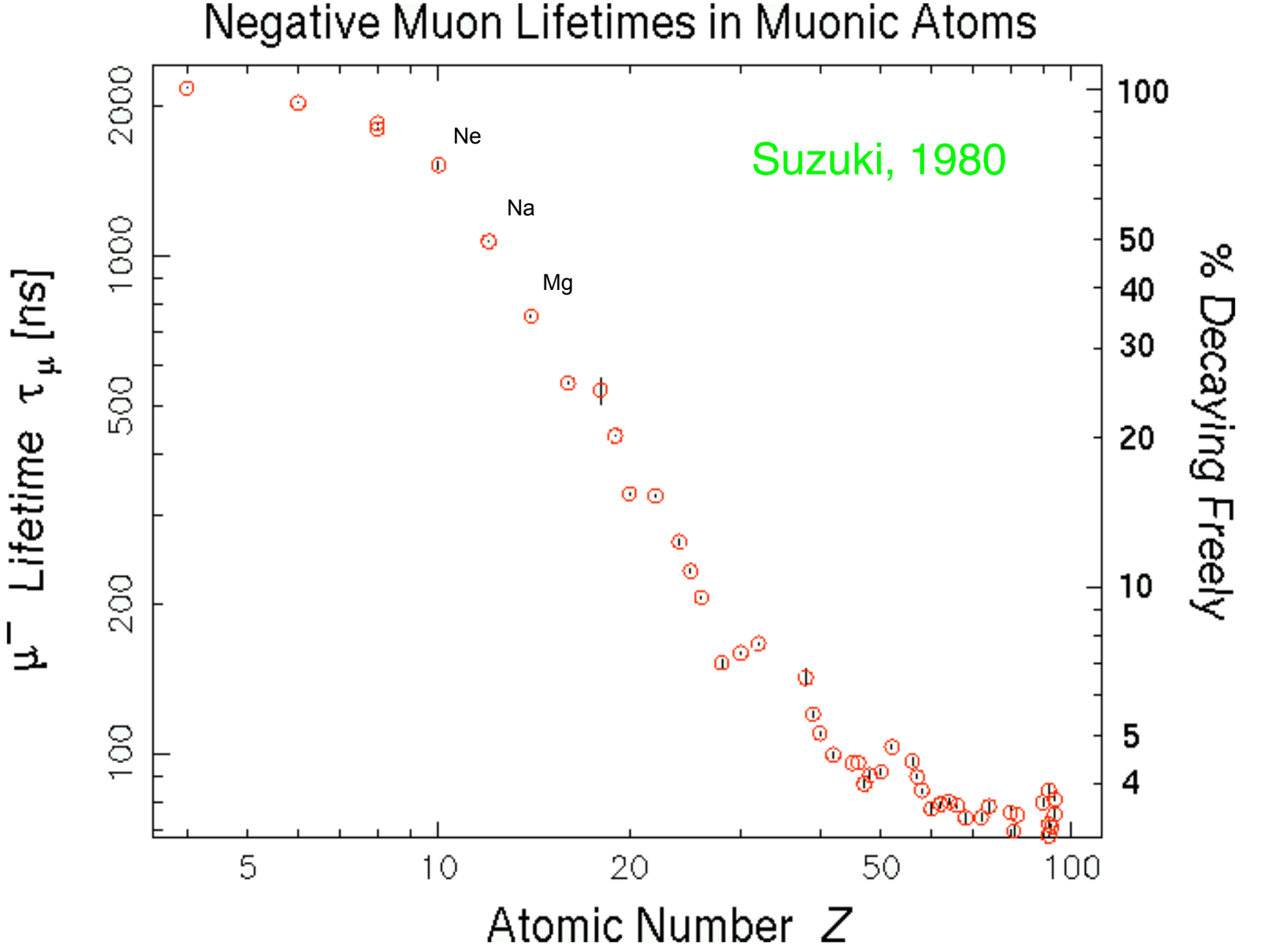
Nuclear μ^- Capture



$\mu^- p \rightarrow n \nu_\mu$ in a nucleus:

Rate exceeds that of $\mu^- \rightarrow e^- \nu_\mu \nu_e$ for $Z \geq 11$.

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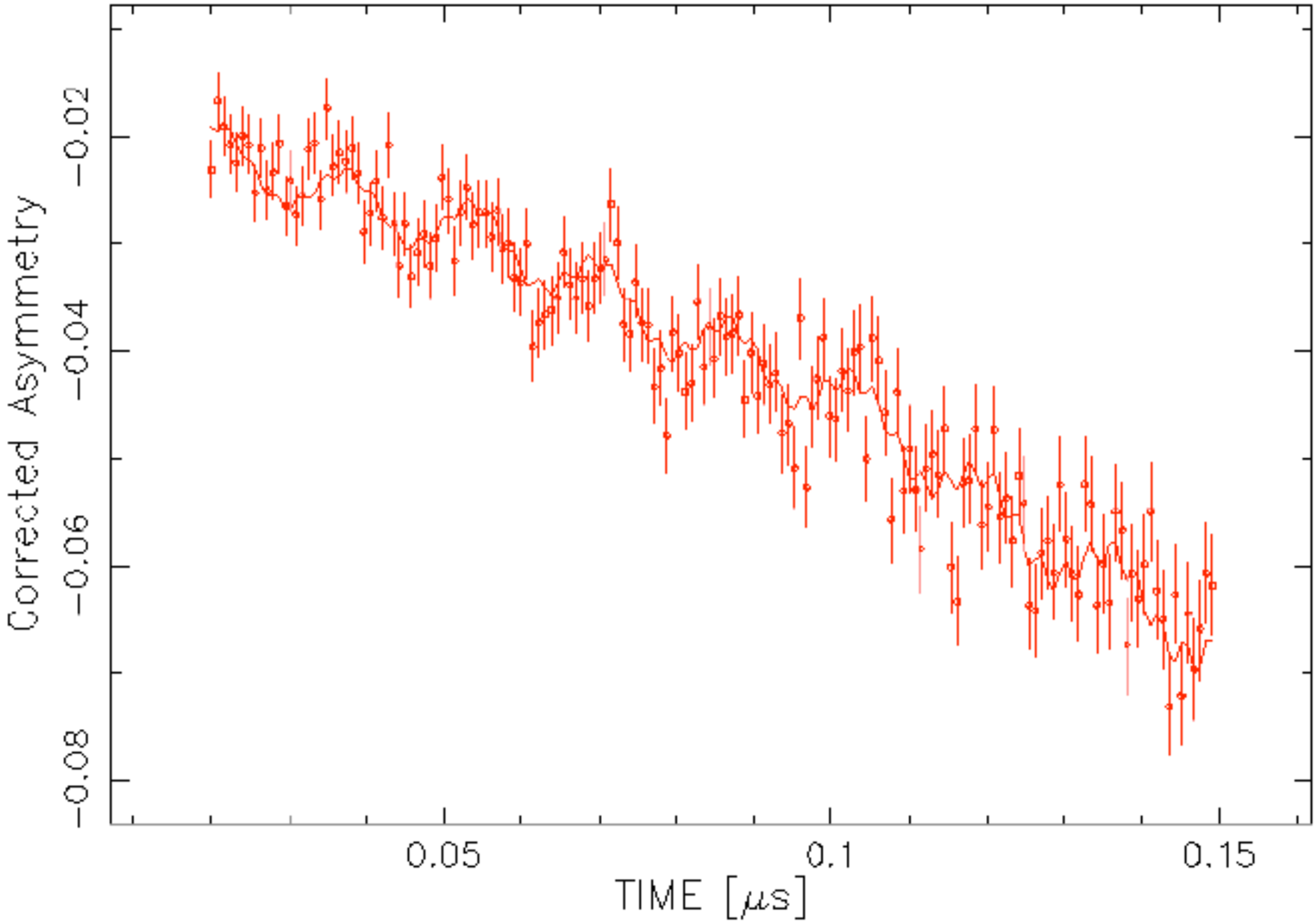
BONUS: μ^-Nb at 2.4 T



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