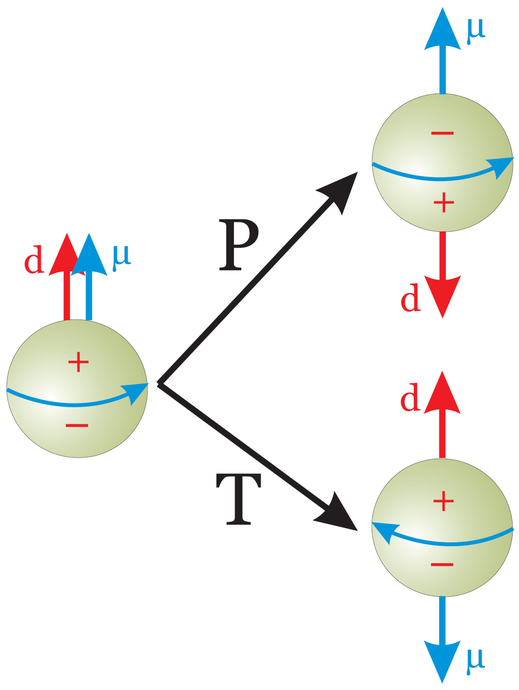
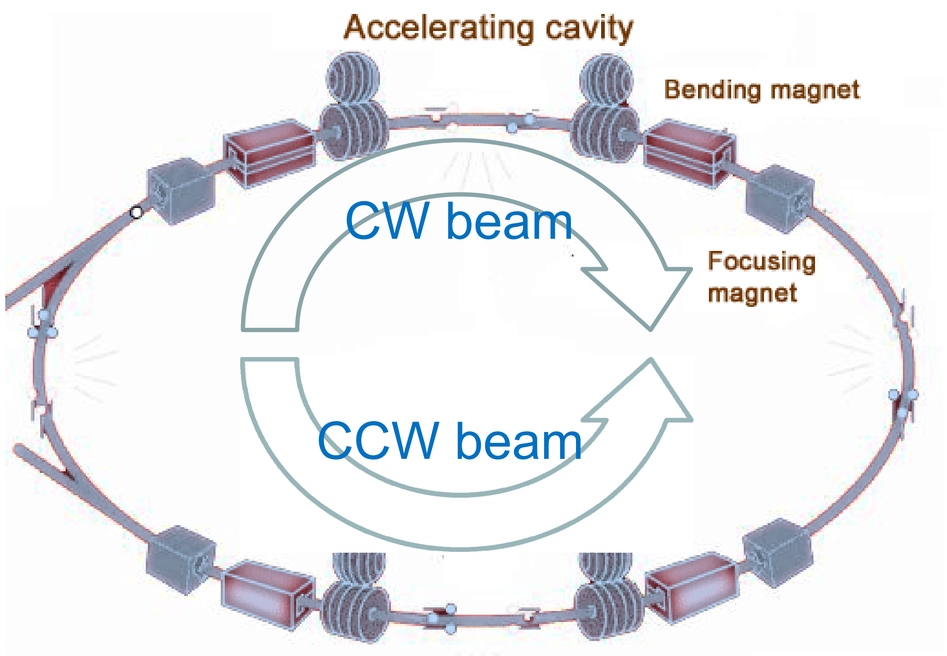


- The amount of matter in the universe far exceeds that of antimatter
- One of the Sakharov conditions for that is the violation of CP-symmetry
- CP- and P-symmetry violations entail non-vanishing P- and T-violating Electric Dipole Moments
- The SM can accommodate CP-violation, but the predicted baryogenesis rate is still far less than what one would expect; simultaneously, it predicts nucleon EDMs of magnitudes 5 orders less than the current upper bound for the neutron
- Hence searches for particle EDMs promise to reveal physics beyond the SM



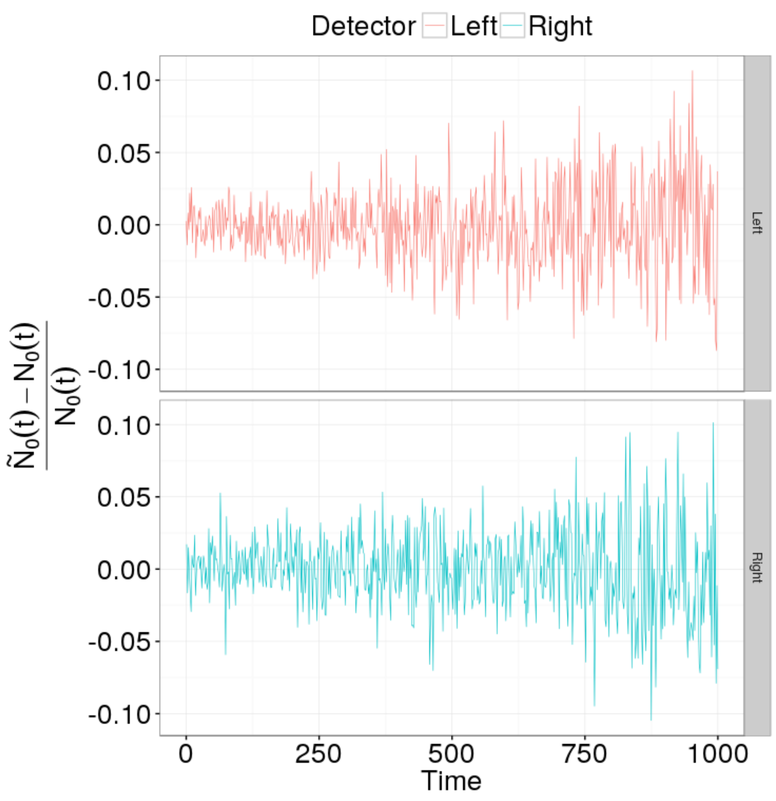
$$\frac{d\vec{S}}{dt} = \vec{\Omega} \times \vec{S}$$

$$\pm\vec{\Omega}_{MDM}$$

$$\vec{\Omega}^{CW/CCW} = -\frac{e}{m}\left\{G\vec{B} + \frac{1}{\gamma^2 - 1}\left(\vec{B} \times \vec{E}\right) + \frac{\eta}{2}\left(\vec{E} + \vec{\beta} \times \vec{B}\right)\right\}$$

$$\vec{\Omega}_{EDM}$$

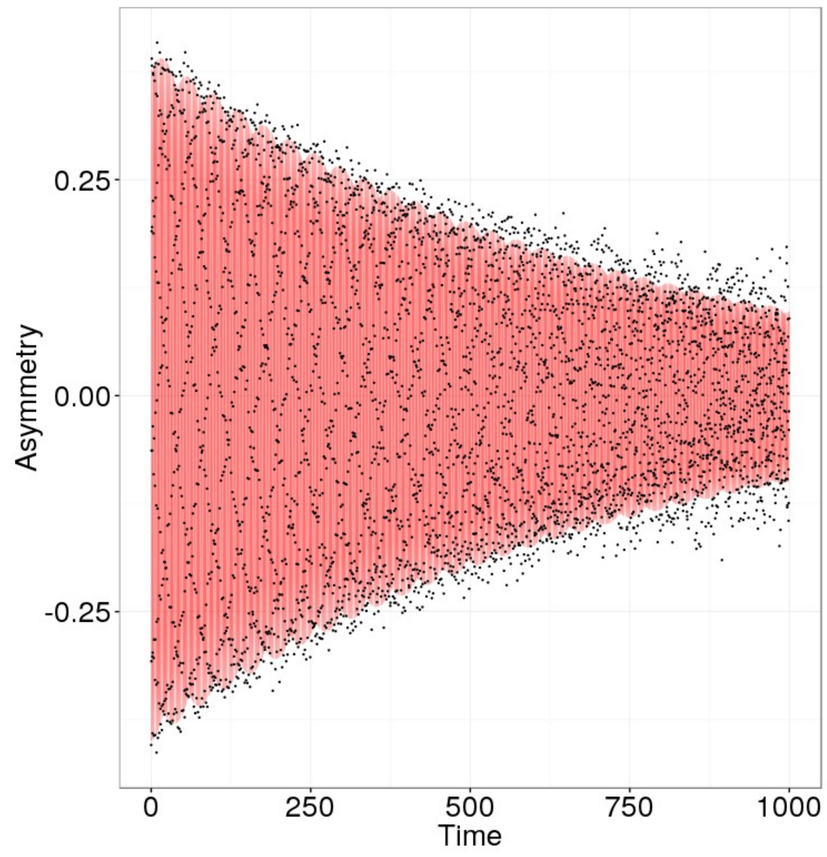
- MDM spin precession ≈ 3 rad/sec
- EDM spin precession ≈ 10^{-9} rad/sec
- Solution: CW/CCW procedure

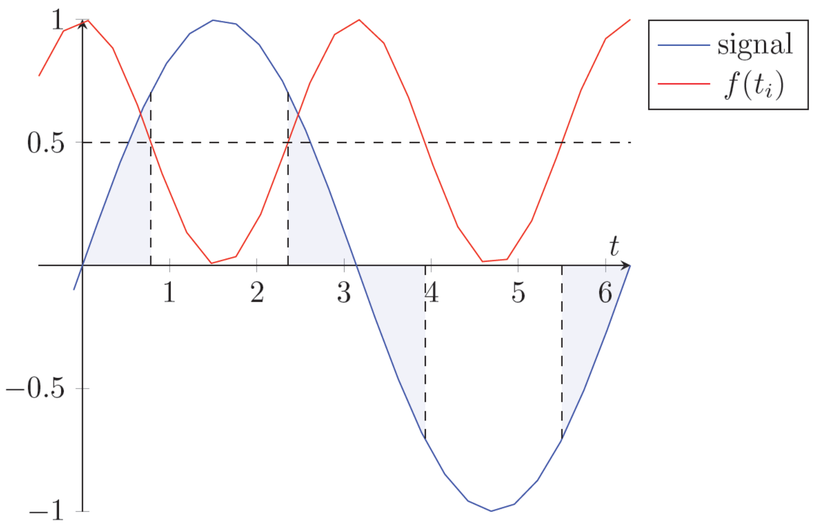


$$\tilde{N}(t) = N_0\left[1 + P \cdot e^{-t/\tau_d} \sin(\omega \cdot t + \phi)\right] + \varepsilon_t$$

$$A = \frac{N_L - N_R}{N_L + N_R} = A_0 e^{\lambda t} \sin(\omega \cdot t + \phi)$$

$$\sigma^2[\hat{\omega}] = \frac{\sigma^2[\varepsilon]}{\sum_i f(t_i) \cdot \sigma_w^2[t]}$$





Sampling	Fisher Info a.u.
uniform	1.00
50% compaction	1.64
80% compaction	1.94

- Uniform sampling
- Sample size equivalent to 2,000 events/20 millisec for 1000 sec

$$\sigma[\hat{\omega}] = 7.55 \cdot 10^{-7}\ \text{rad/sec}$$

By modulating the sampling frequency we can potentially improve the precision of the frequency estimate by a factor of √2

An error on the order of 10^{-6} rad/sec is sufficient for a 30% improvement in precision

- A measurement of the EDM on the order of **10^{-29} e·cm** requires a standard error of the frequency estimate be better than **10^{-9} rad/sec**

- Modeling shows that such precision can be achieved in **one year** of measurement by the application of a modulated sampling strategy