For TA MSD we find:

$$\left\langle \overline{\delta^2(\Delta; t_a, T)} \right\rangle = \frac{1}{T-\Delta} \int_{t_a}^{t_a+T-\Delta} \left(x(t+\Delta) - x(t) \right)^2 dt$$

$$= \frac{\Lambda_\alpha(t_a/T)}{\Gamma(1+\alpha)} \frac{g(\Delta)}{T^{1-\alpha}}$$

$g(\Delta) = \Delta$ for free motion, $g(\Delta) \simeq \Delta^{1-\alpha}$ under confinement

universal prefactor $\Lambda_\alpha(z) = (1+z)^\alpha - z^\alpha$ for entire range of Δ!

"Death of linear response":

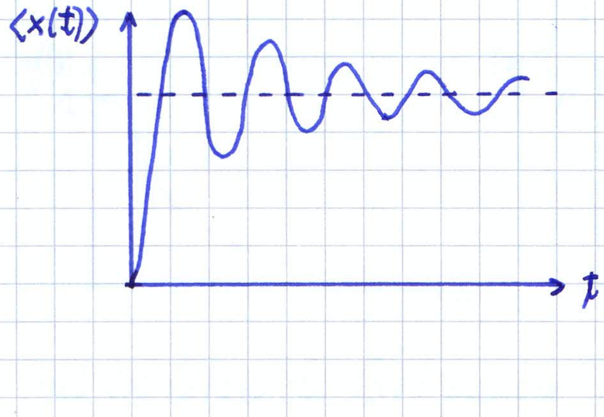
In presence of a time-dependent external force $F(t)$, the fractional Fokker-Planck equation becomes (Sokolov & Klafter, PRL 97, 140602 (2006)):

$$\frac{\partial}{\partial t} P(x,t) = \left(-\frac{F(t)}{m\eta_\alpha} \frac{\partial}{\partial x} + K_\alpha \frac{\partial^2}{\partial x^2} \right) {}_0D_t^{1-\alpha} P(x,t).$$

Consider an harmonic forcing of the form $F(t) = F_0 \sin \omega t$.

The first moment becomes

$$\langle x(t) \rangle = \frac{F_0}{m\eta_\alpha} \sqrt{2\pi}\, S\left(\sqrt{\frac{2t}{\pi}}\right)$$ in terms of the Fresnel integral $S(z) = \int_0^z \sin\left(\frac{\pi t^2}{2}\right) dt$



Thus the particle experiences an initial shift. Due to longer & longer waiting times, it shows oscillations of decreasing amplitude.