Relaxation and aging in jammed glasses

Stefan Boettcher
Department of Physics, Emory University, Atlanta, GA 30322, USA

Abstract:

We provide a unified description of ”aging”, the increasingly sluggish dynamics widely observed in the jammed state of disordered materials, in terms of record dynamics. Structural evolution in aging materials requires ever larger, record-sized rearrangements in an uncorrelated sequence of intermittent events (avalanches or quakes). According to record statistics, these (irreversible!) rearrangements occur at a rate ≈ 1/t. Hence, in this log-Poisson statistics, the number of events between a waiting time tw and any later time t integrates to ≈ ln(t/tw), such that any observable inherits the t/tw-dependence that is the hallmark of pure aging. Based on this description, we can explain the relaxation dynamics observed numerically and experimentally in a broad range of materials, such as low-temperature spin glasses and high-density colloids and granular piles [1,2,3]. We have proposed a phenomenological model of record dynamics that reproduces salient aspects, for example, the van-Hove distribution of displacements, intermittency and dynamic heterogeneity, over 12 decades in time using the waiting-time method [3,4]. Our studies also rules out some other explanations of aging based on trap models and continuous-time walks [5].

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[5] SB et al, https://arxiv.org/abs/1803.06580.