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Predictability sieve, pointer states, and the classicality of quantum trajectories DIEGO DALVIT, Los Alamos National Laboratory, JACEK DZIARMAGA, Jagelonian University, WOJCIECH ZUREK, Los Alamos National Laboratory — We study various measures of classicality of the states of open quantum systems subject to decoherence. Classical states are expected to be stable in spite of decoherence, and are thought to leave conspicuous imprints on the environment. Here these expected features of environment-induced superselection (einselection) are quantified using four different criteria: predictability sieve (which selects states that produce least entropy), purification time (which looks for states that are the easiest to find out from the imprint they leave on the environment), efficiency threshold (which finds states that can be deduced from measurements on a smallest fraction of the environment), and purity loss time (that looks for states for which it takes the longest to lose a set fraction of their initial purity). We show that when pointer states – the most predictable states of an open quantum system selected by the predictability sieve – are well defined, all four criteria agree that they are indeed the most classical states. We illustrate this with two examples: an underdamped harmonic oscillator, for which coherent states are unanimously chosen by all criteria, and a free particle undergoing quantum Brownian motion, for which most criteria select almost identical Gaussian states (although, in this case, predictability sieve does not select well defined pointer states.) Reference: D.A.R. Dalvit, J. Dziarmaga, and W.H. Zurek, Phys. Rev. A 72, 062101 (2005).

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