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Amplification of Information by Photons and the Quantum Chernoff Bound[1] MICHAEL ZWOLAK, Oregon State University, C. JESS RIEDEL, IBM Watson Research Center, WOJCIECH H. ZUREK, Los Alamos National Laboratory — Amplification was regarded, since the early days of quantum theory, as a mysterious ingredient that endows quantum microstates with macroscopic consequences, key to the "collapse of the wavepacket," and a way to avoid embarrassing problems exemplified by Schrödinger's cat. This bridge between the quantum microworld and the classical world of our experience was postulated ad hoc in the Copenhagen Interpretation. Quantum Darwinism views amplification as replication, in many copies, of information about quantum states. We show that such amplification is a natural consequence of a broad class of models of decoherence, including the photon environment we use to obtain most of our information. The resultant amplification is huge, proportional to $^\sharp\mathcal{E}\bar{\xi}_{\mathcal{QCB}}$. Here, $^\sharp\mathcal{E}$ is the environment size and $\bar{\xi}_{QCB}$ is the "typical" Quantum Chernoff Information, which quantifies the efficiency of the amplification. The information communicated though the environment is imprinted in the states of individual environment subsystems, e.g., in single photons, which document the transfer of information into the environment and result in the emergence of the classical world.

[1]See, http://mike.zwolak.org

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