Organic/inorganic hybrid perovskite thin films are promising materials for photovoltaic applications that exhibit significant heterogeneity in local non-radiative recombination rates. In this talk, we will describe both optical and scanning-probe microscopy studies that help elucidate the origins of this local heterogeneity in terms of composition and surface defects. We further show how specific processing additives and illumination serve to alter the distribution of these states, and demonstrate the “photo-cleaning” effects in perovskite are associated with photo-induced ion motion.