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A General Prescription for Digging Too Deeply in Imaging Surveys ERIC SUCHYTA, ERIC HUFF, KLAUS HONSCHEID, Ohio State Univ - Columbus, DARK ENERGY SURVEY COLLABORATION — Dark energy comprises the vast majority (>70%) of the energy density of the universe, but its physical nature is still very much a mystery. The most sensitive probes of dark energy in the foreseeable future are likely to weak lensing measurements from large space- and ground-based astronomical imaging surveys. The very sensitivity of these measurements, however, leaves them especially susceptible to small systematic biases. The diagnosis and removal of systematic errors in weak lensing measurements – especially "unknown unknowns" – is one of the foremost concerns in cosmological measurement today. We present an overview of a new, general method for optimal measurement and systematic error diagnosis in imaging surveys designed to address these issues. Our method perturbs the real images by embedding a known signal – simulated lensed galaxies, convolved with the instrument's response – and show how measurements on the modified images can be used to derive unbiased estimators for the signal in question that are optimal (i.e., that saturate the Cramer-Rao bound) for the specific observing conditions and data quality in hand. We also show how embedding a known systematic error can be used to diagnose and remove problems in the lensing measurement. Finally, we present some preliminary results from the application of this formalism to Dark Energy Survey images, and describe the resulting improvements in the statistical and systematic error budget.

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