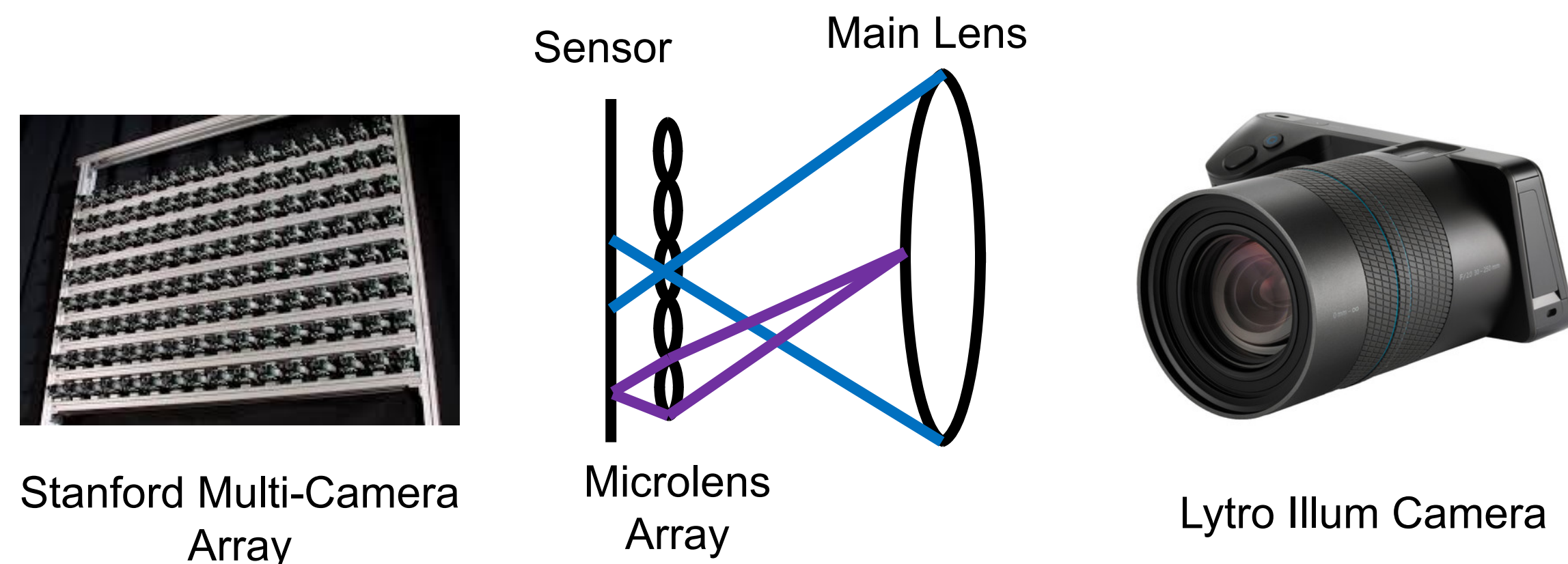


Super Resolution with Light Field Images

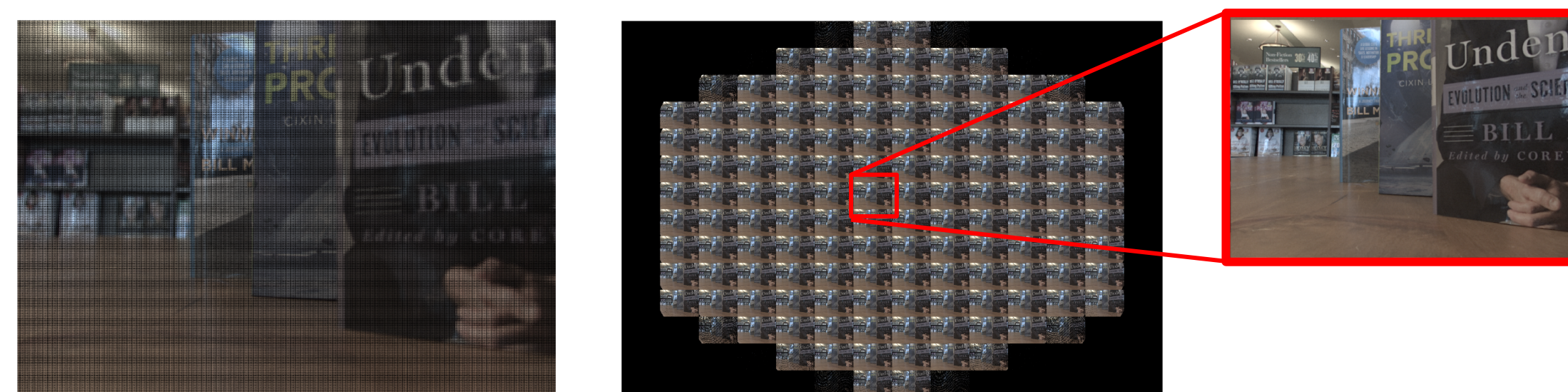
Anna Broome

Department of Electrical Engineering, Stanford University

Motivation & Background



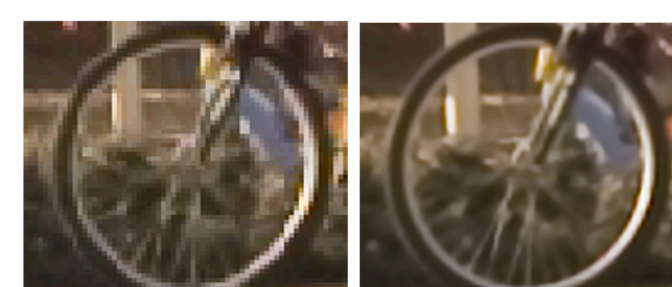
- Camera arrays (left) or microlens arrays on top of a sensor (middle, right) can be used to capture the 4D light field of a scene
- Inherent spatio-angular resolution tradeoff



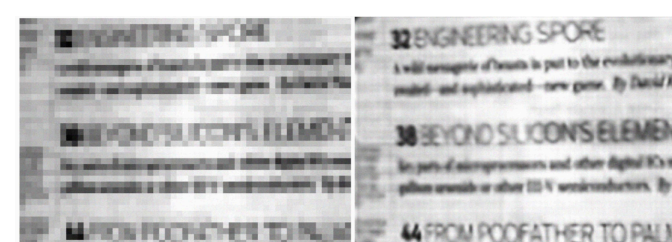
- Goal: Use super resolution methods to improve the spatial resolution of a light field image



Super resolution pre demosaicing [1].

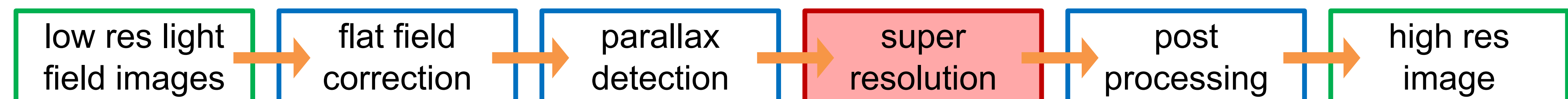


Gaussian and sparse priors [2].



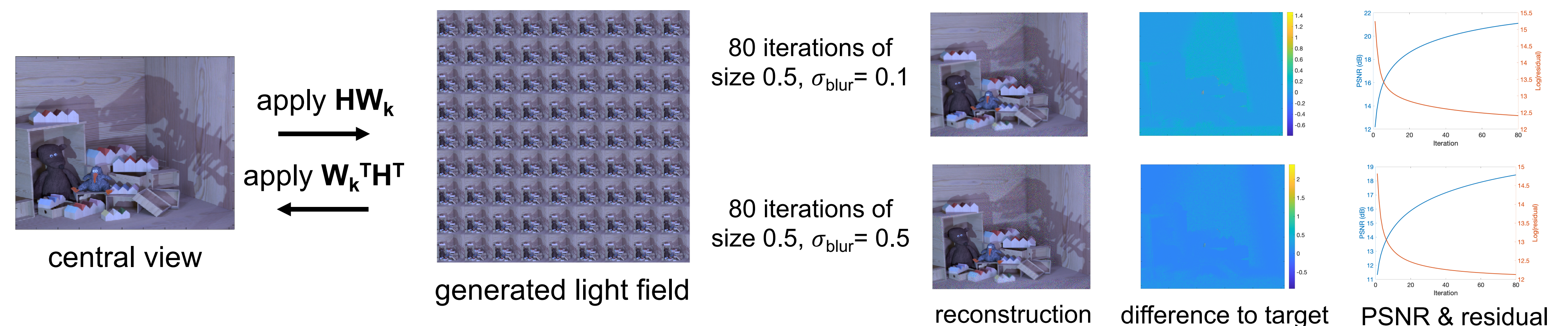
Variational Bayesian reconstruction [3].

Methodology



- Dataset: 4D Light Field Benchmark [4]
 - 9 x 9 x 512 x 512 x 3 simulated light fields
 - disparity maps corresponding to the central view
- Image formation forward model: $\mathbf{y}_k = \mathbf{D}\mathbf{H}\mathbf{W}_k\mathbf{x} + \mathbf{n}_k$
 - $\mathbf{y}_k$ = k-th sub aperture image
 - $\mathbf{W}_k$ = shift matrix of k-th sub image
 - $\mathbf{D}$ = sampling matrix
 - $\mathbf{x}$ = estimate of high res image
 - $\mathbf{H}$ = blur matrix (optics + sensor)
 - $\mathbf{n}_k$ = i.i.d. gaussian noise
- Solve using gradient descent, iterative optimization algorithm

Results & Future Work



- Future work: implement sampling matrix, $\mathbf{D}$, try different optimization methods (i.e. ADMM, MAP, etc.) and other priors (i.e. TV, Gaussian, etc.)