

Inverse problem: Image deblurring



Direct and inverse problem of image deblurring

Direct problem:

Given a sharp photograph, what would the blurred version of the image look like?

Inverse problem:

Given a blurred photograph, reconstruct the sharp image

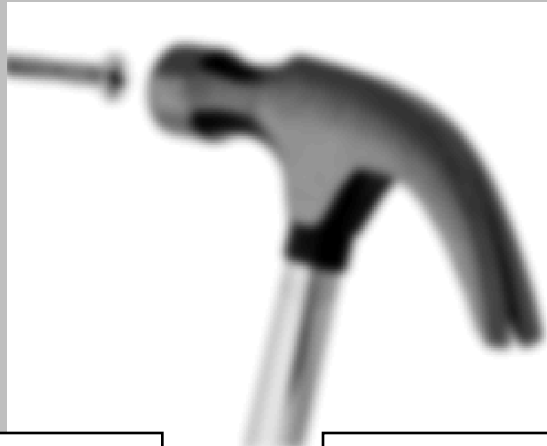
The inverse problem is more difficult

Original image



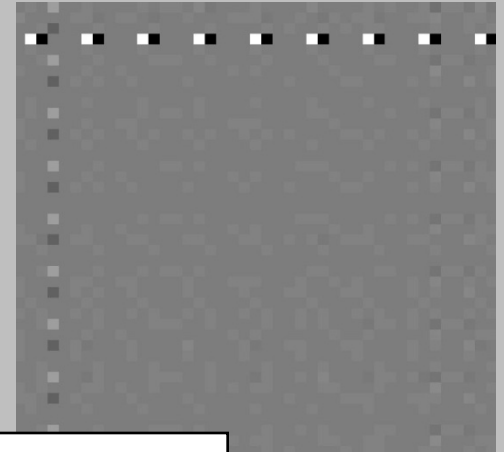
Direct problem

Blurred image



Inverse problem

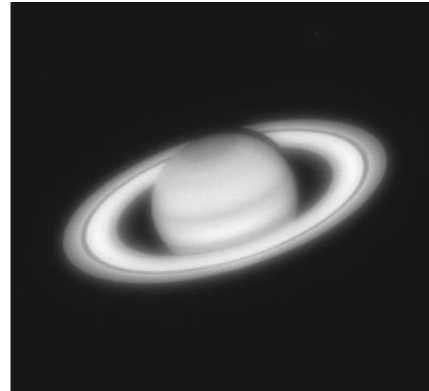
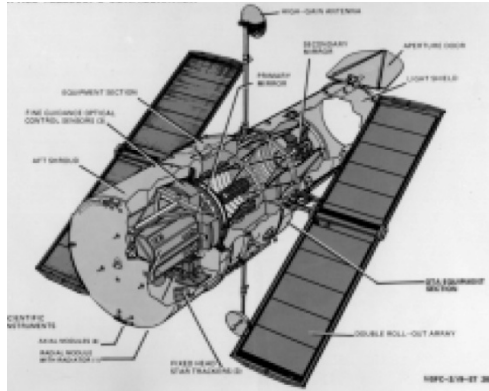
Simple inversion



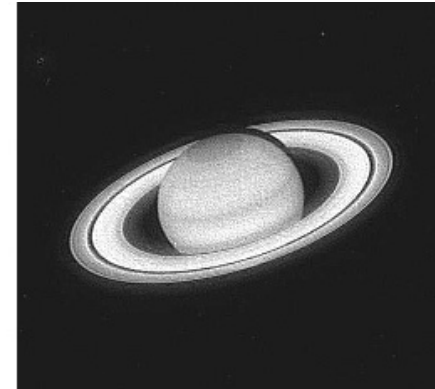
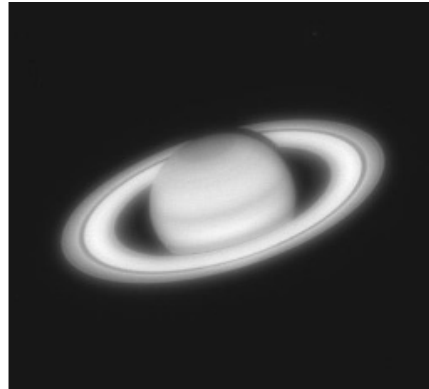
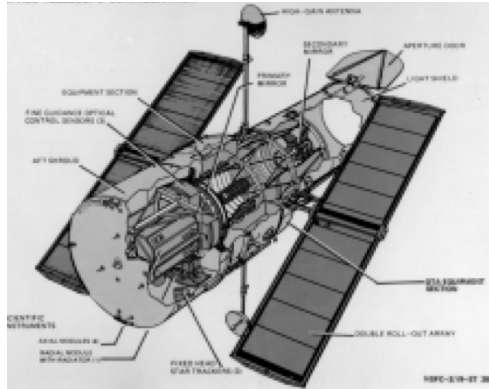
**With properly regularized inversion
we can sharpen the photograph**



The Hubble space telescope had a flaw in its mirror, resulting in blurred images

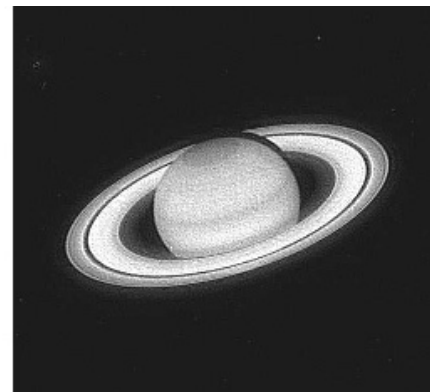
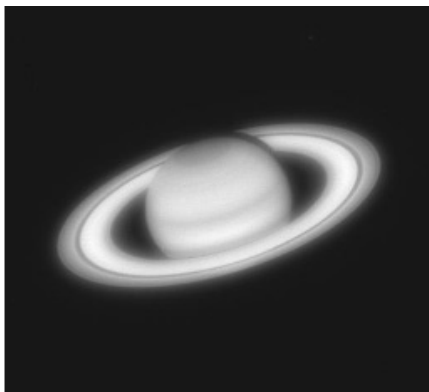
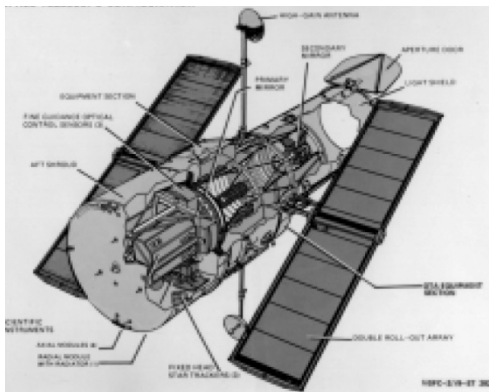


The mirror flaw was compensated by a deconvolution algorithm

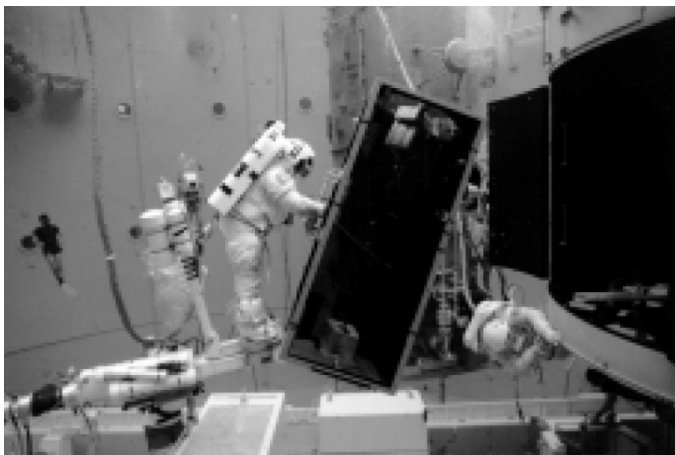


Source: NASA, Quarktet

The mirror flaw was compensated by a deconvolution algorithm



The mirror was replaced in 1993. However, even the new sharp images could be further enhanced with deconvolution!



Source: NASA, Quarktet