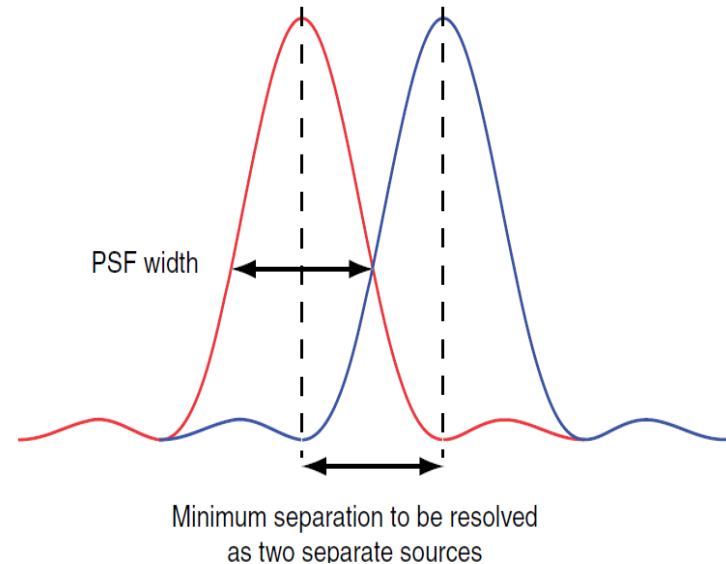
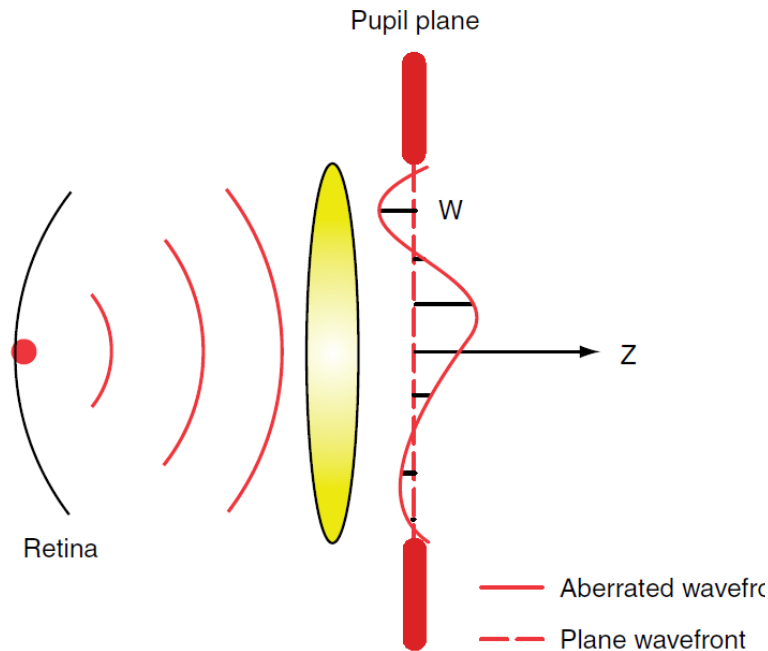


---

# Digital holographic adaptive optics

- Motivation
- Principle of AO
- Conventional AO
- DHAO
- Results

# Motivation



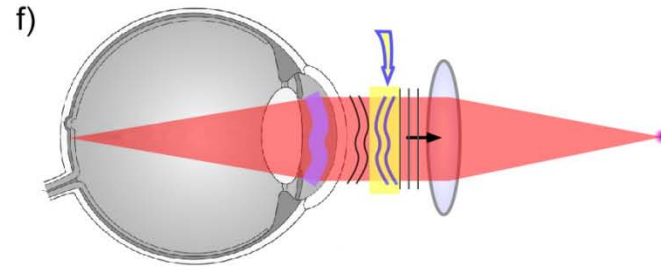
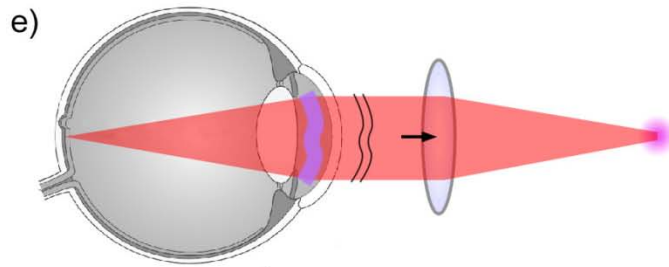
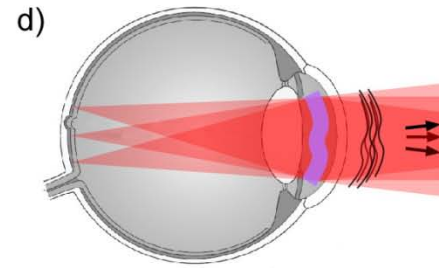
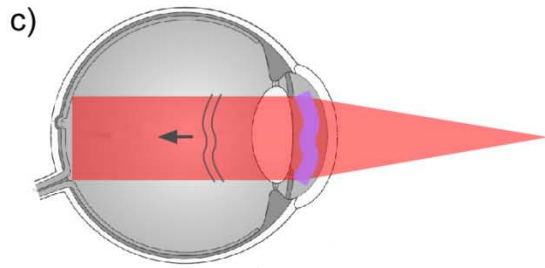
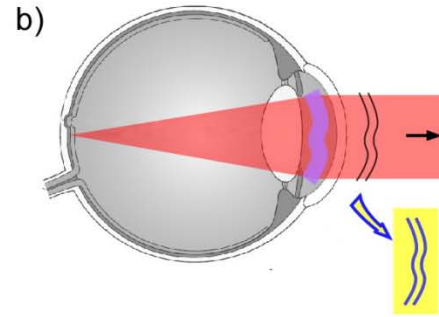
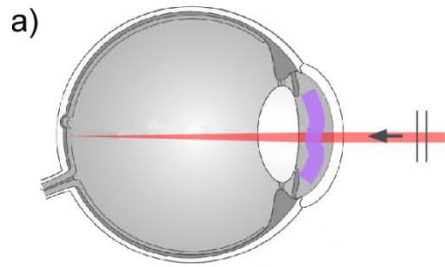
$$\text{rms: } \sigma = [\sum (W - W_{\text{ave}})^2]^{1/2} / N$$

$$\text{Strehl ratio} = \exp[-(2\pi\sigma)^2]$$

$$PSF_{\text{width}} = \frac{1.22\lambda f}{nD}$$

K.Hampson, 3425, JMO, 55:3425(2008)

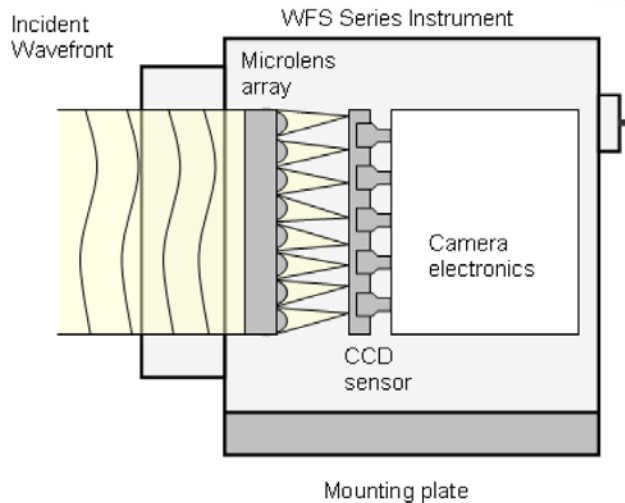
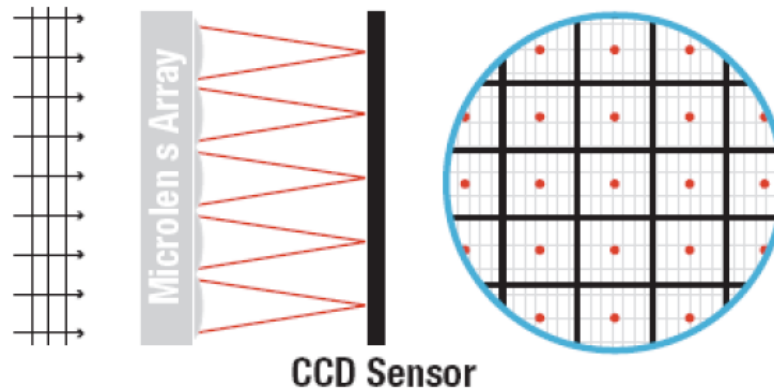
# Principle of AO



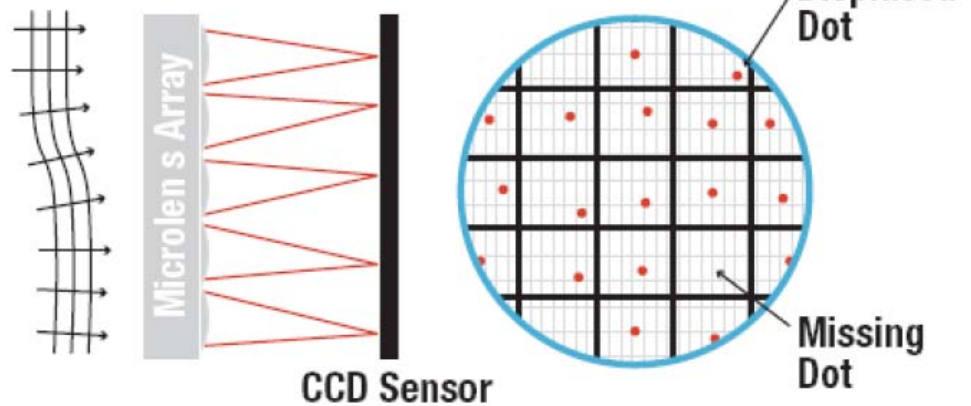
# Hartman-Shack Wavefront sensor



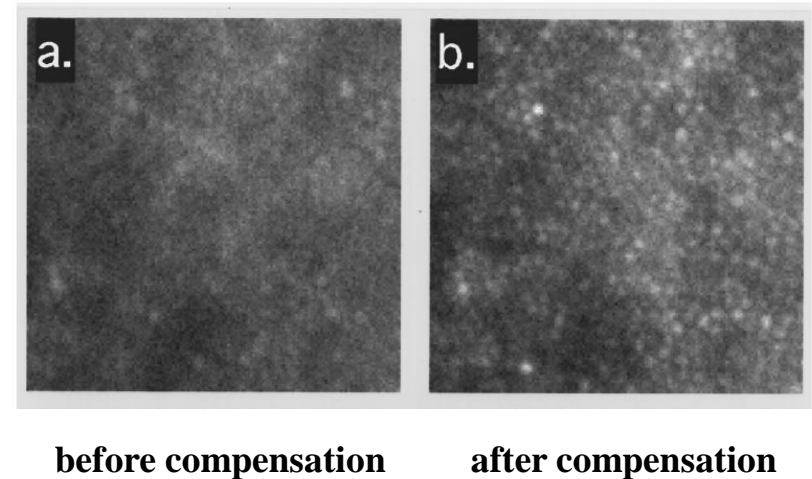
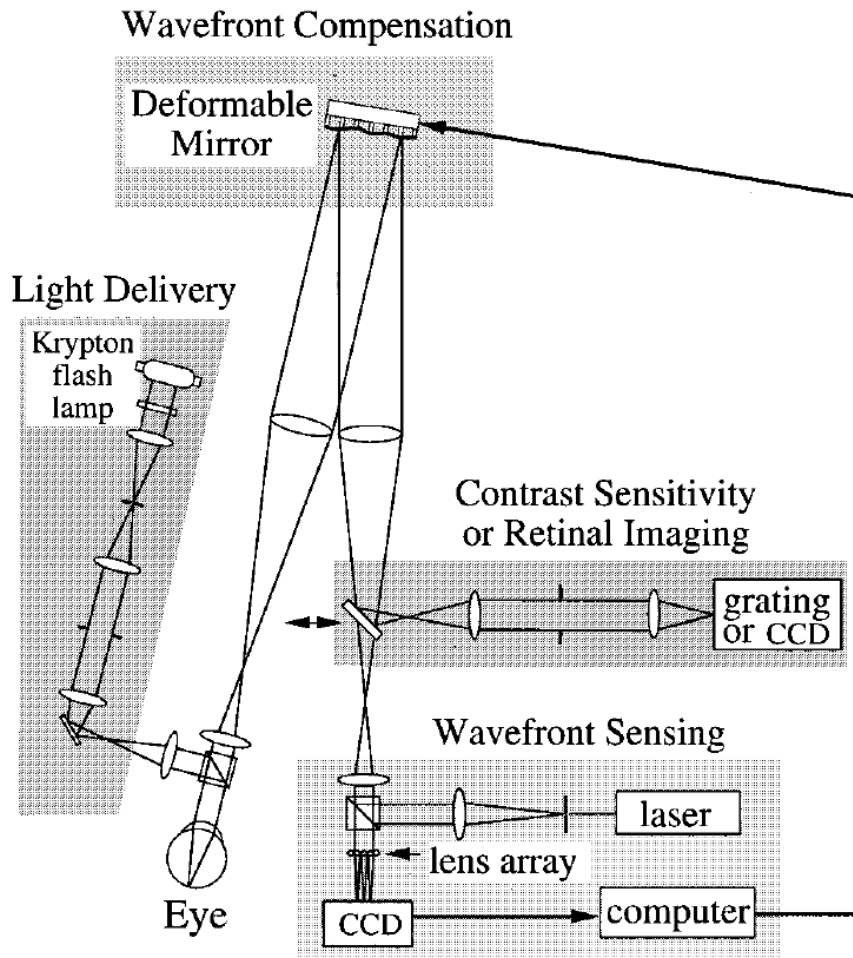
Planar Wavefront



Distorted Wavefront

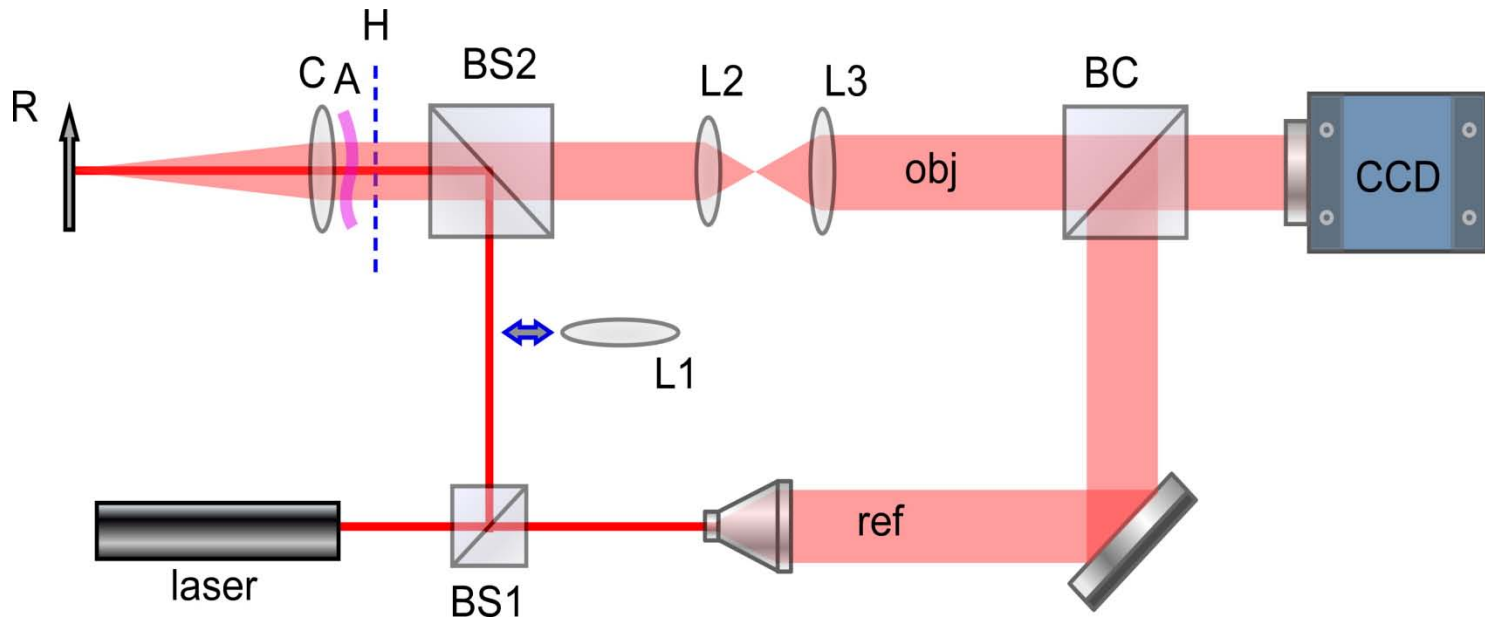


# Traditional AO system



J.Liang, et. al. JOSA, 14:2884(1997)

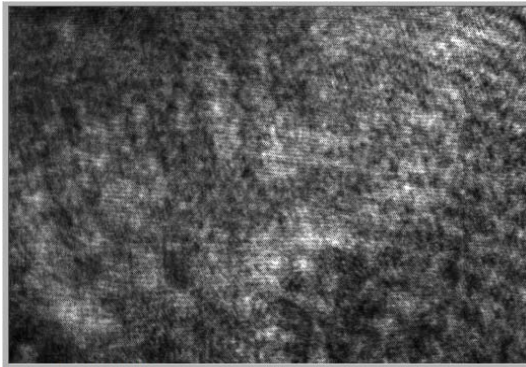
# DHAO



**R:retina      A:aberrator,**  
**BS:Beamsplitter   BC:Beam combiner**

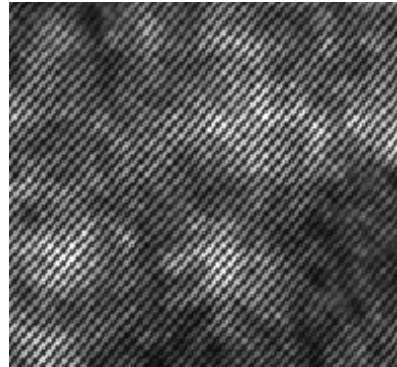
C. Liu and, M. K. Kim, Opt. Lett.,36:2710(2011)

# Proof of the principle

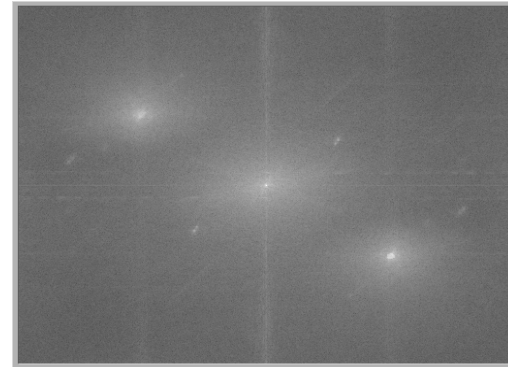


4762 x 3571 (1024 x 768) 4:255

**hologram: 4762 $\mu$ m  $\times$  3571 $\mu$ m**

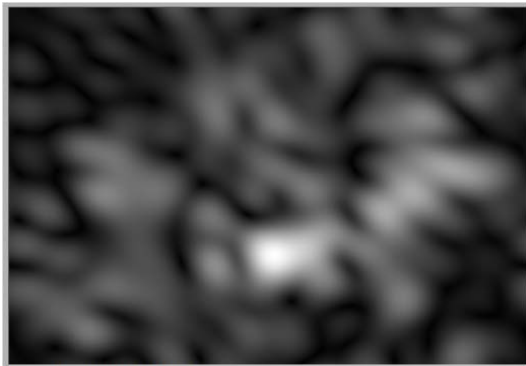


**detail of hologram**



1.351 x 1.351 (1024 x 768) -2.123:4.746

**angular spectrum**

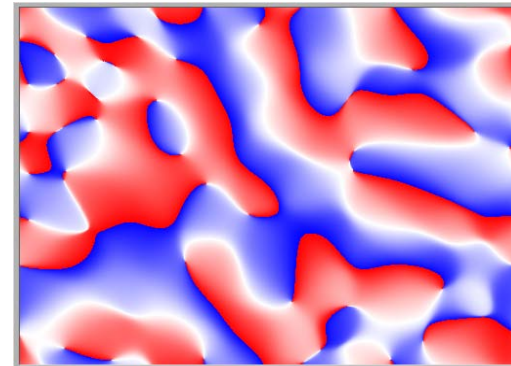


4762 x 3571 (1024 x 768) 0.005781:38.19

**amplitude**



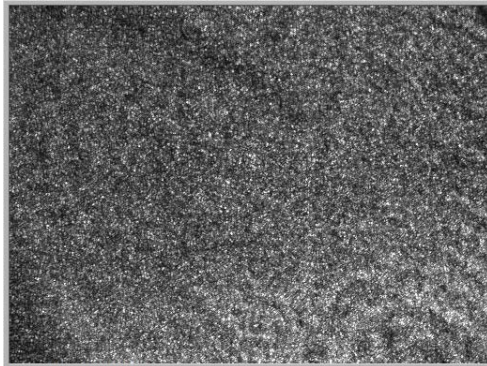
**detail of amplitude**



4762 x 3571 (1024 x 768) -3.142:3.142

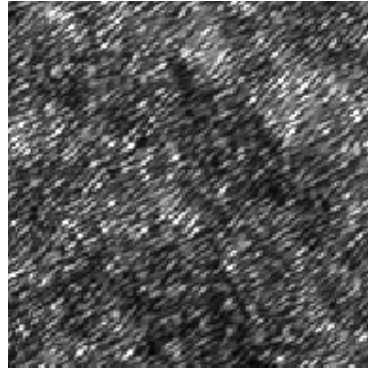
**phase aberration**

# Proof of the principle

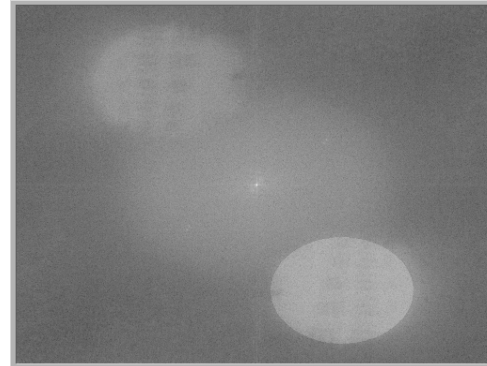


4762 x 3571 (1024 x 768) 5:255

**hologram: 4762 $\mu\text{m}$   $\times$  3571 $\mu\text{m}$**

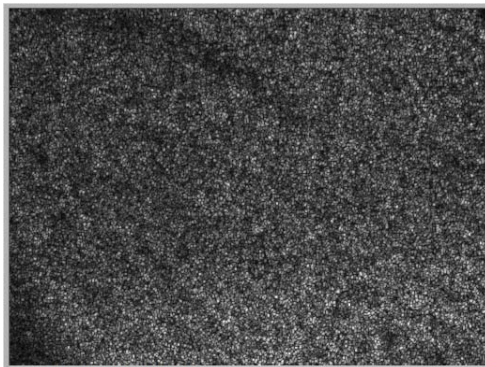


**detail of hologram**



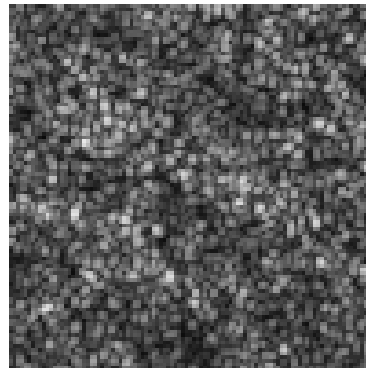
1.351 x 1.351 (1024 x 768) -1.895:4.782

**angular spectrum**

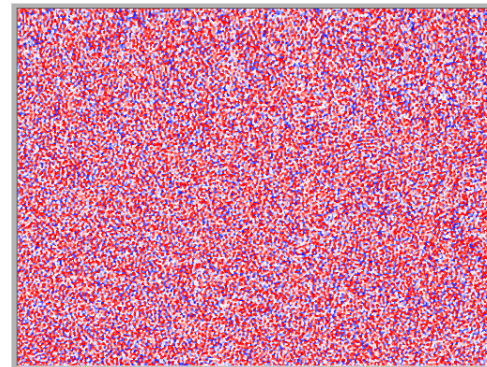


4762 x 3571 (1024 x 768) 0.008937:66.57

**amplitude**



**detail of amplitude**

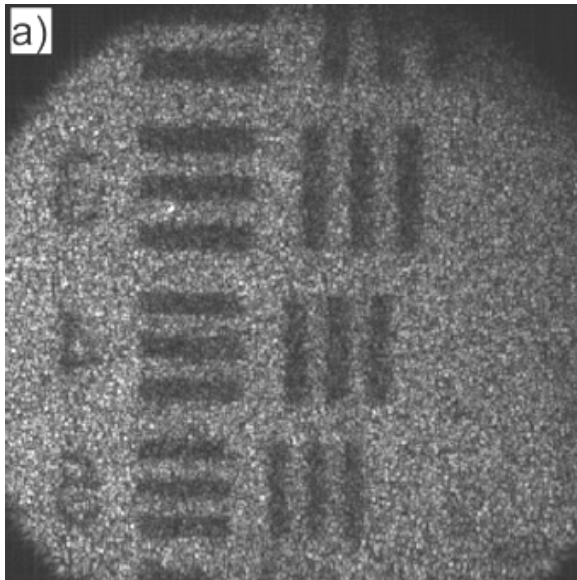


4762 x 3571 (1024 x 768) -3.142:3.142

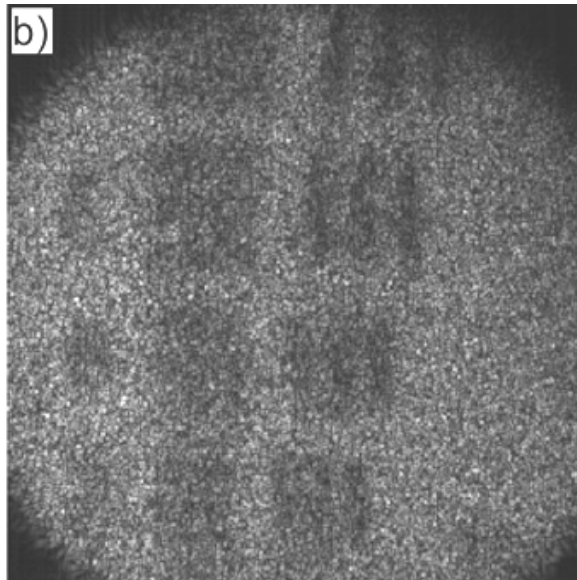
**phase aberration**



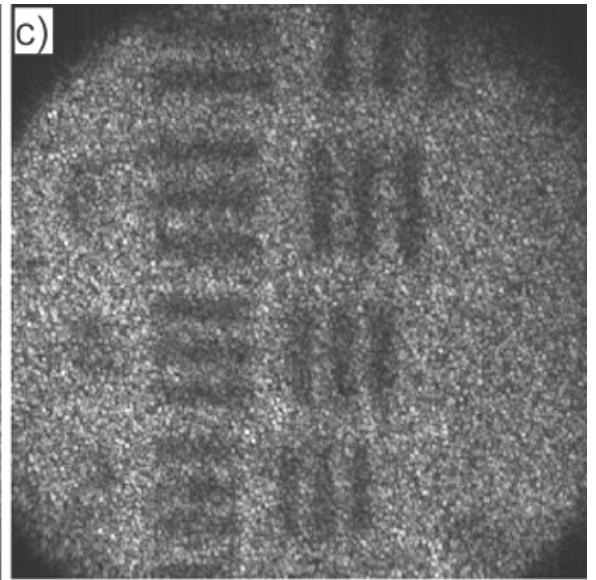
# Proof of the principle



**image without aberration**



**aberrated image**



**Corrected image**

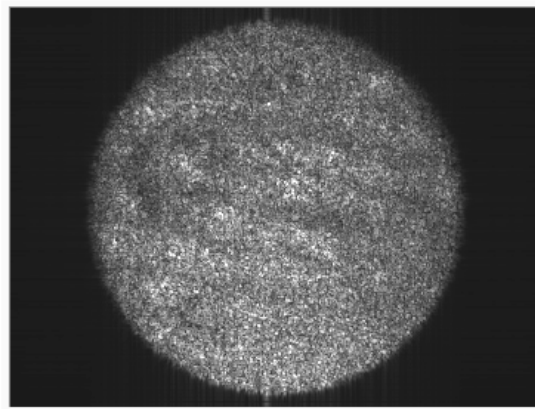
**FOV: 2134 $\mu$ m  $\times$  1601 $\mu$ m**

# Onion tissue



4762 x 3571 (1024 x 768) 0:255

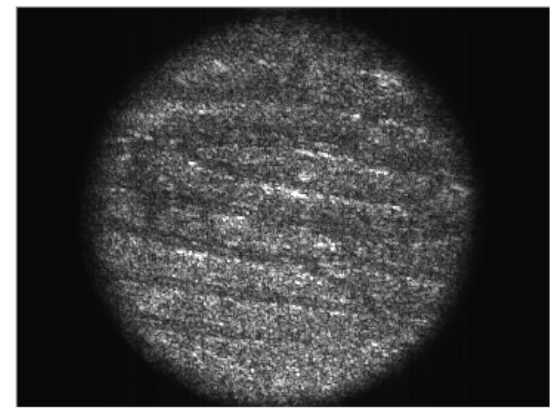
**image without aberration**



4762 x 3571 (1024 x 768) 0.0001084:147.8

**aberrated image**

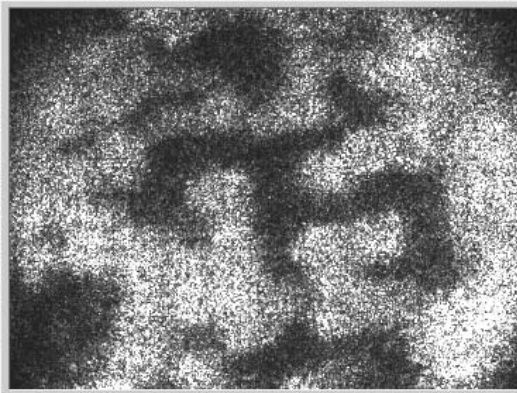
**FOV: 990 $\mu$ m  $\times$  714 $\mu$ m**



4762 x 3571 (1024 x 768) 0.001484:3377

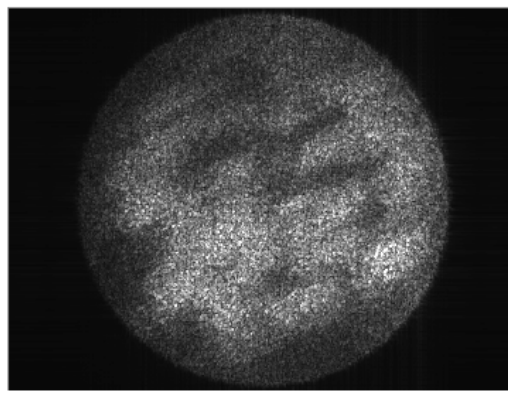
**Corrected image**

# Butterfly wing



4762 x 3571 (1024 x 768) 0:255

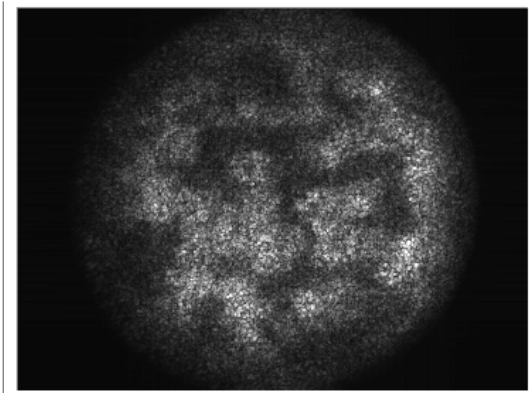
**image without aberration**



4762 x 3571 (1024 x 768) 5.199E-5:60.83

**aberrated image**

**FOV: 990 $\mu$ m  $\times$  714 $\mu$ m**



4762 x 3571 (1024 x 768) 0.0009571:523

**Corrected image**

---

# DHAO on Cow eye's retina