



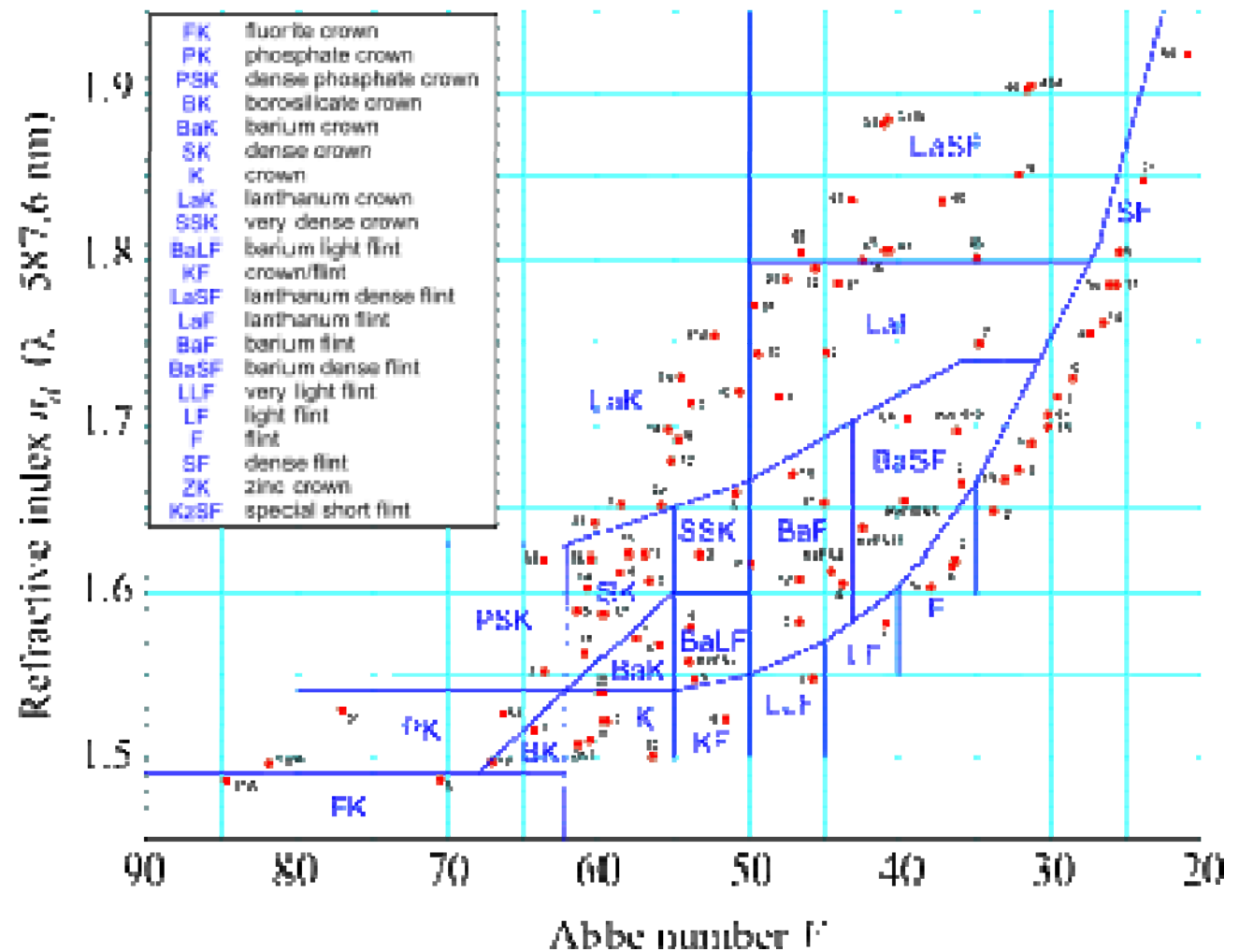
# Misc Optics Slides

# Abbe Diagram

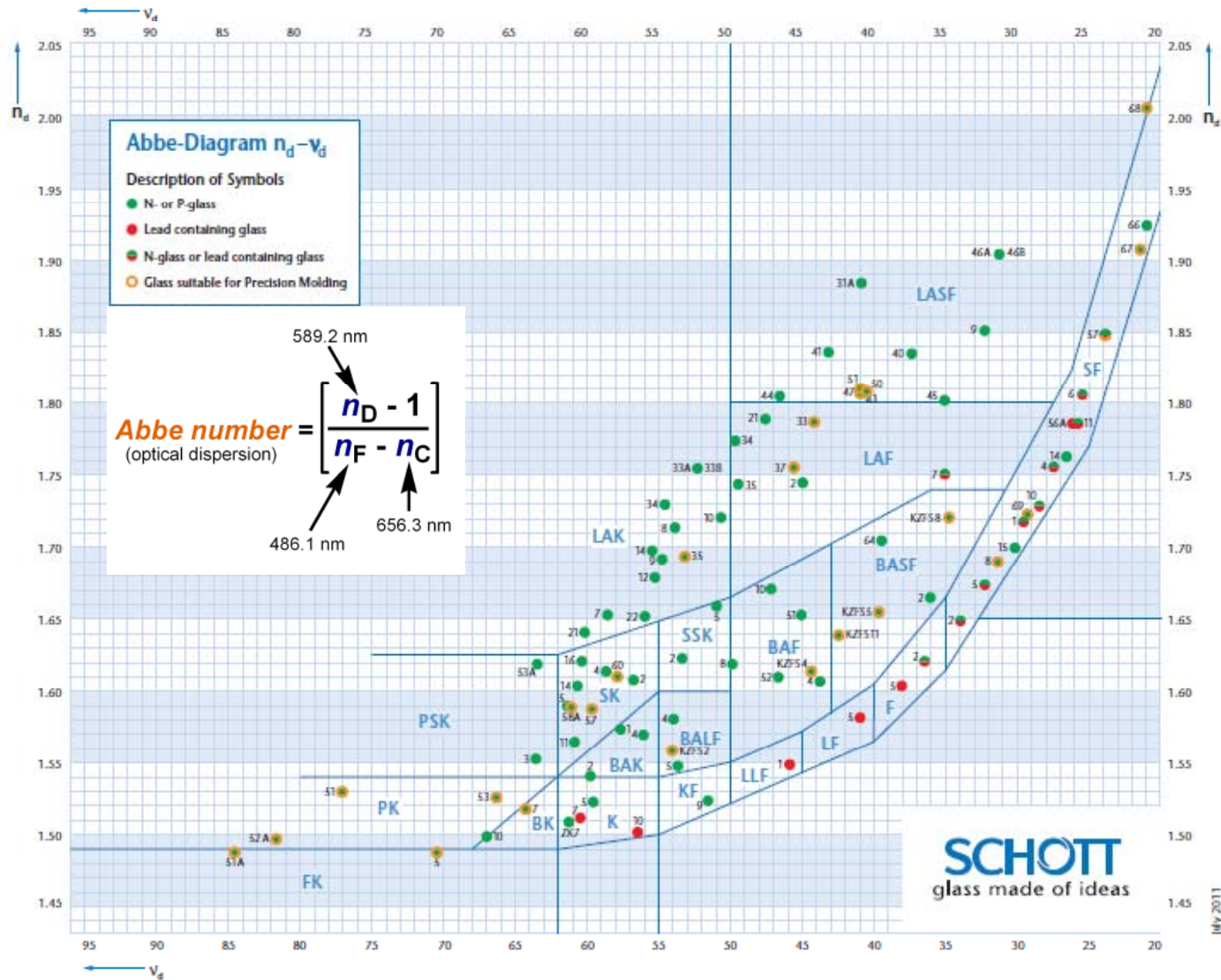
**Abbe number**  
(optical dispersion)

$$= \frac{n_D - 1}{n_F - n_C}$$

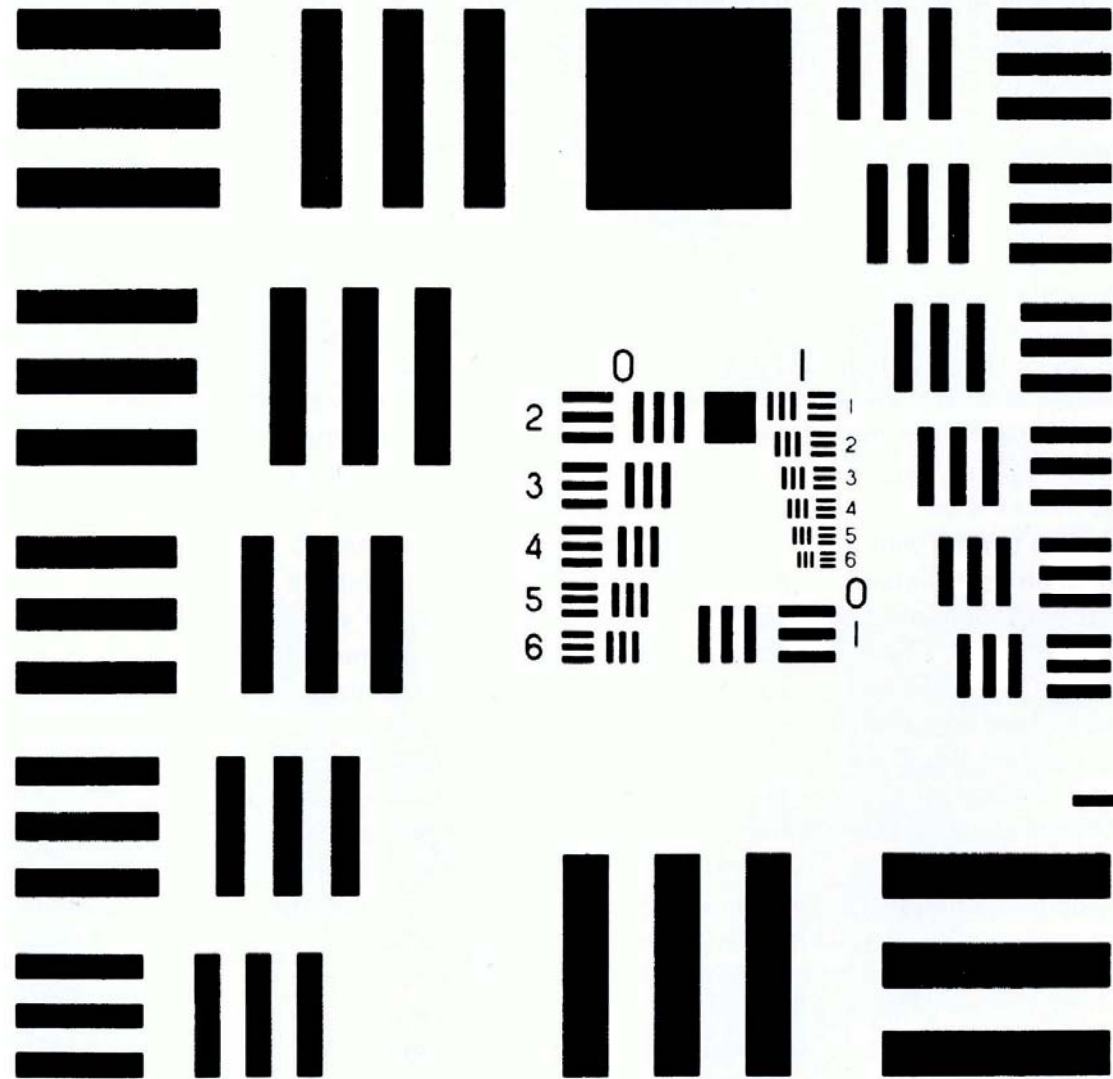
589.2 nm (points to  $n_D$ )  
 486.1 nm (points to  $n_F$ )  
 656.3 nm (points to  $n_C$ )



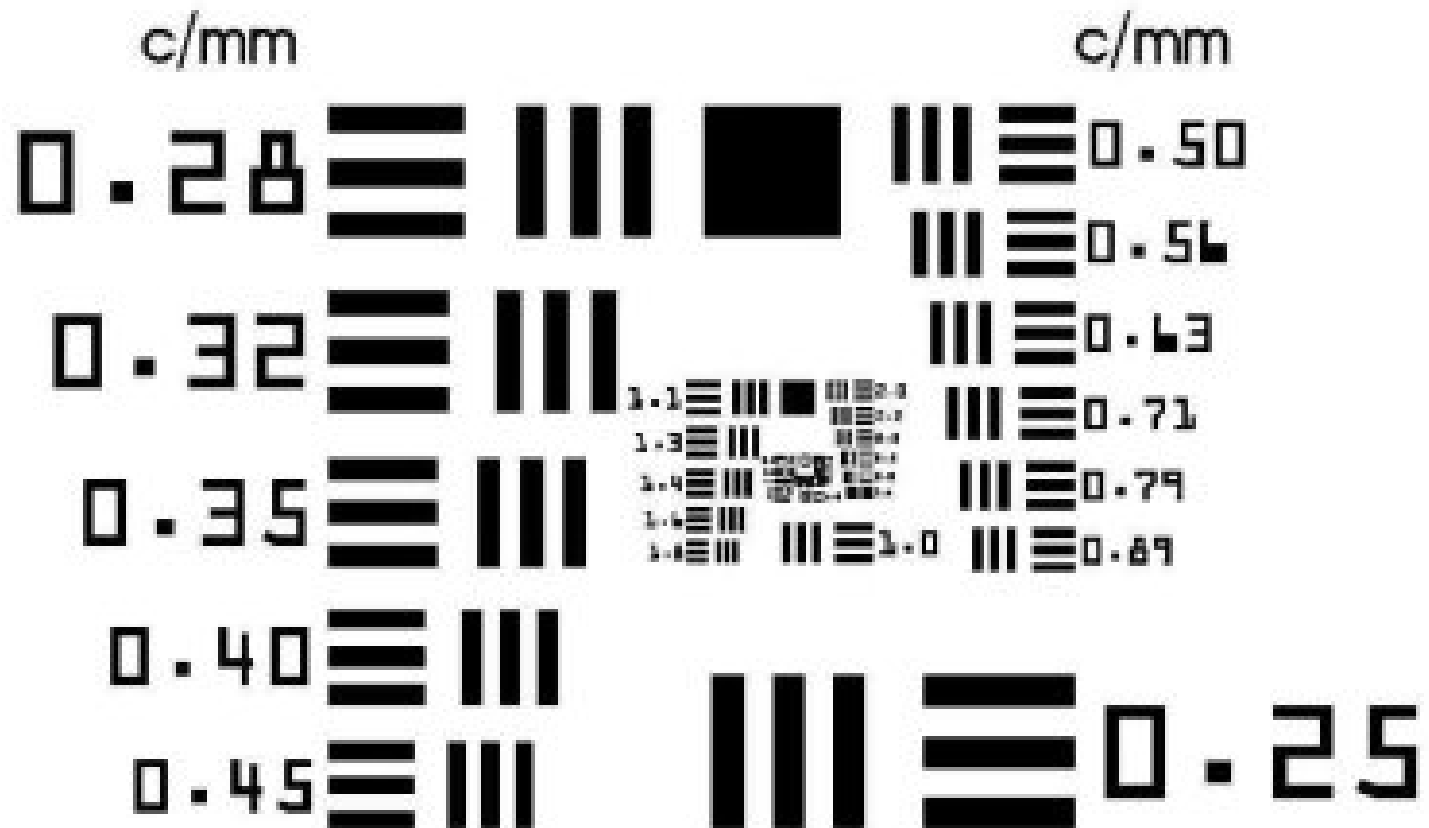
# Abbe Diagram



# 1951 USAF Bar Chart



T-21 / USAF-1951  
 Labeled in cycles per mm  
 (meets requirements of Mil-Std-150A)

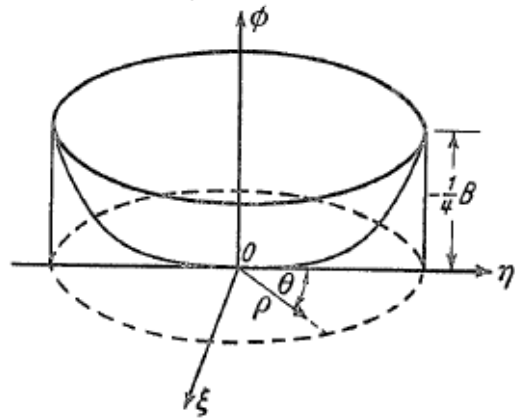


# Primary Wave aberrations

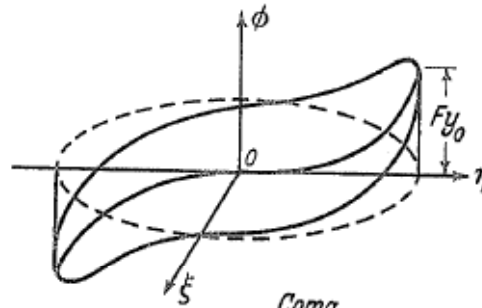
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PRINCIPLES OF OPTICS

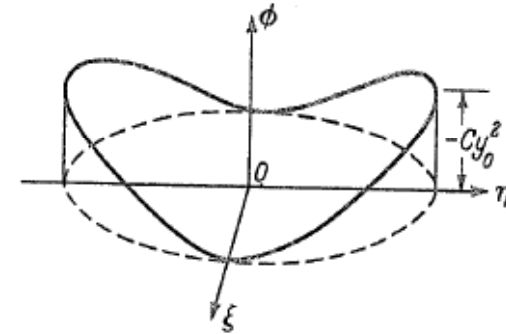
[5.3



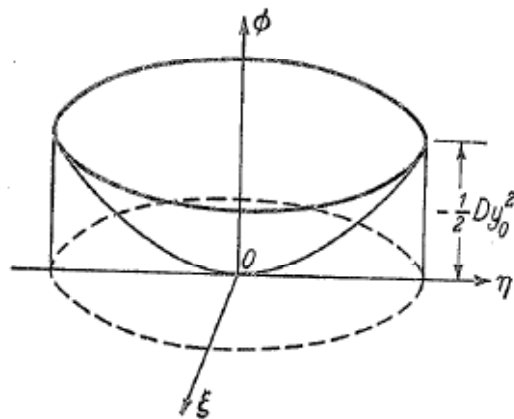
Spherical aberration  
 $\phi = -\frac{1}{4}B\rho^4$   
 (a)



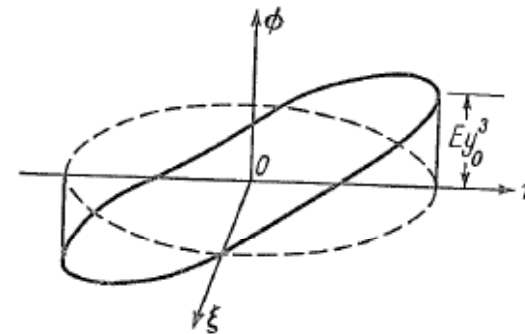
Coma  
 $\phi = Fy_0\rho^3\cos\theta$   
 (b)



Astigmatism  
 $\phi = -Cy_0^2\rho^2\cos^2\theta$   
 (c)

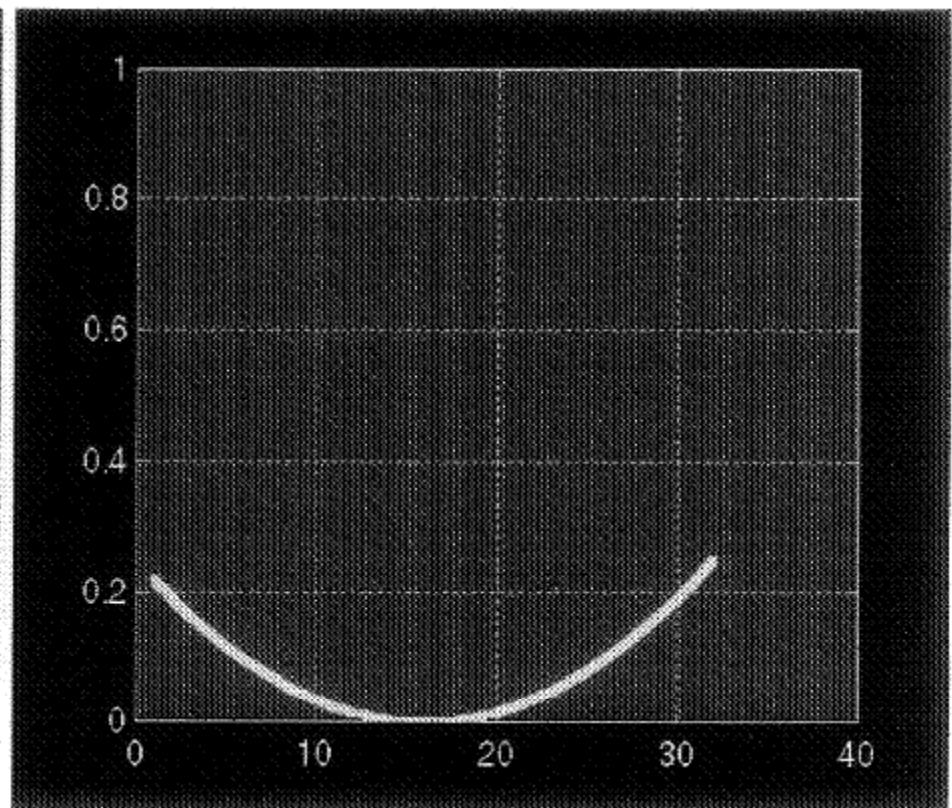
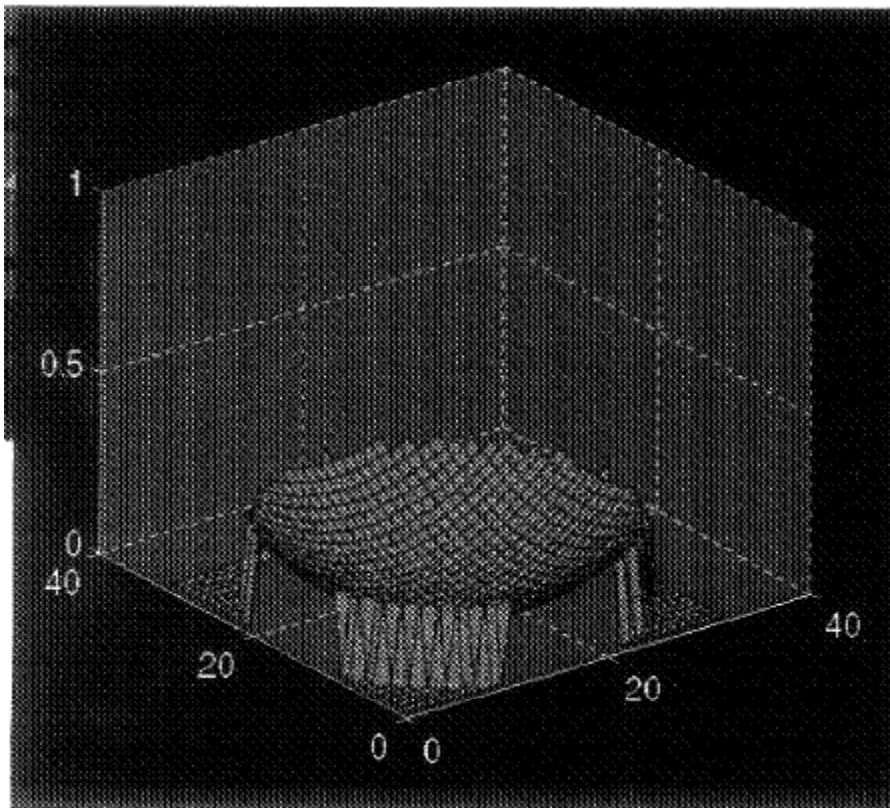


Curvature of field  
 $\phi = -\frac{1}{2}Dy_0^2\rho^2$   
 (d)

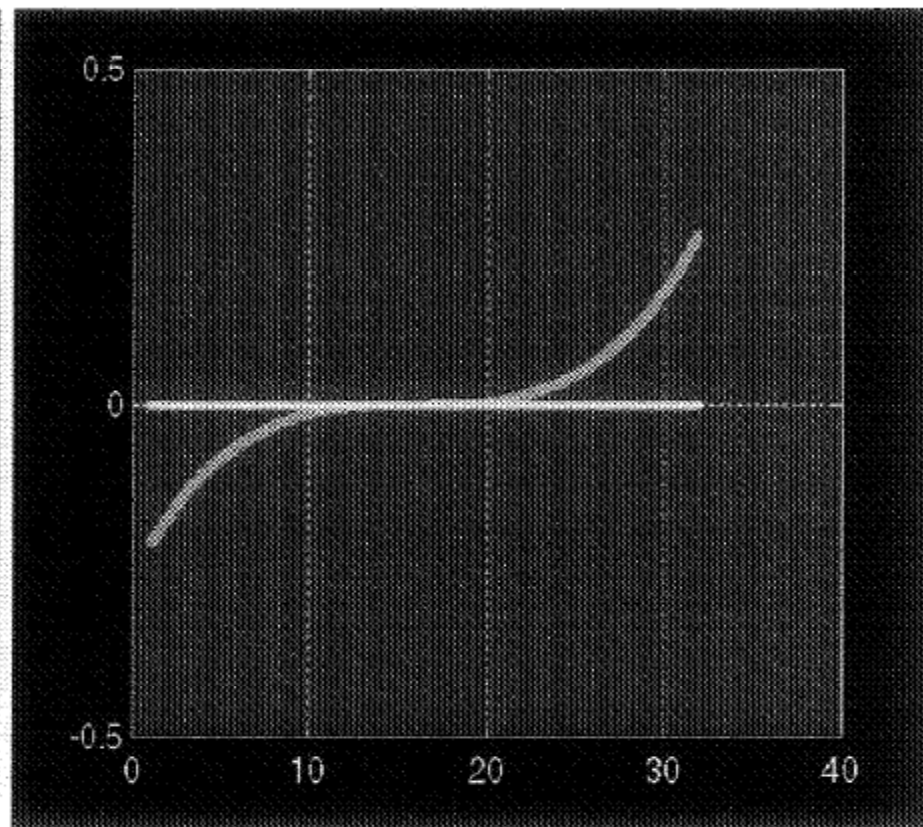
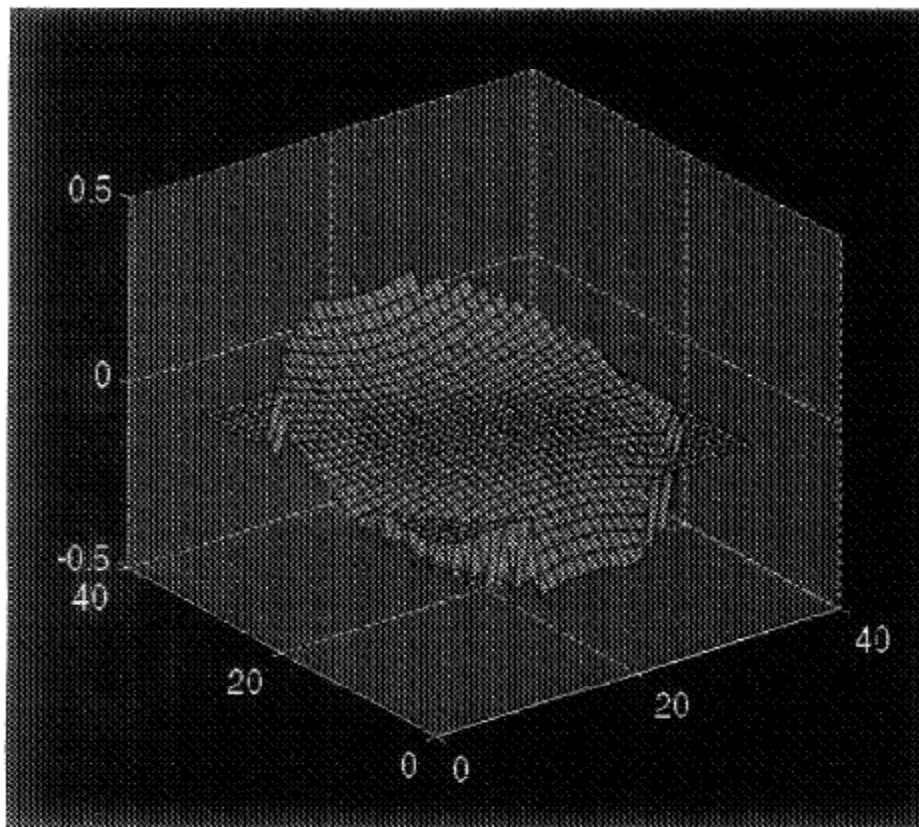


Distortion  
 $\phi = Ey_0^3\rho\cos\theta$   
 (e)

# Defocus

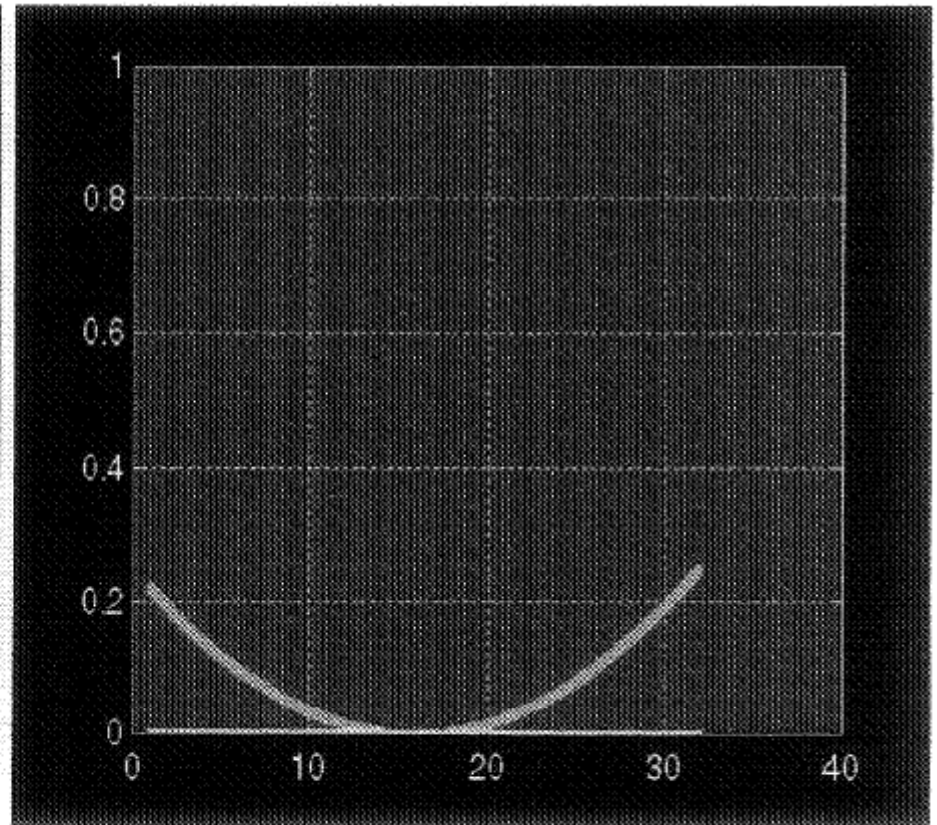
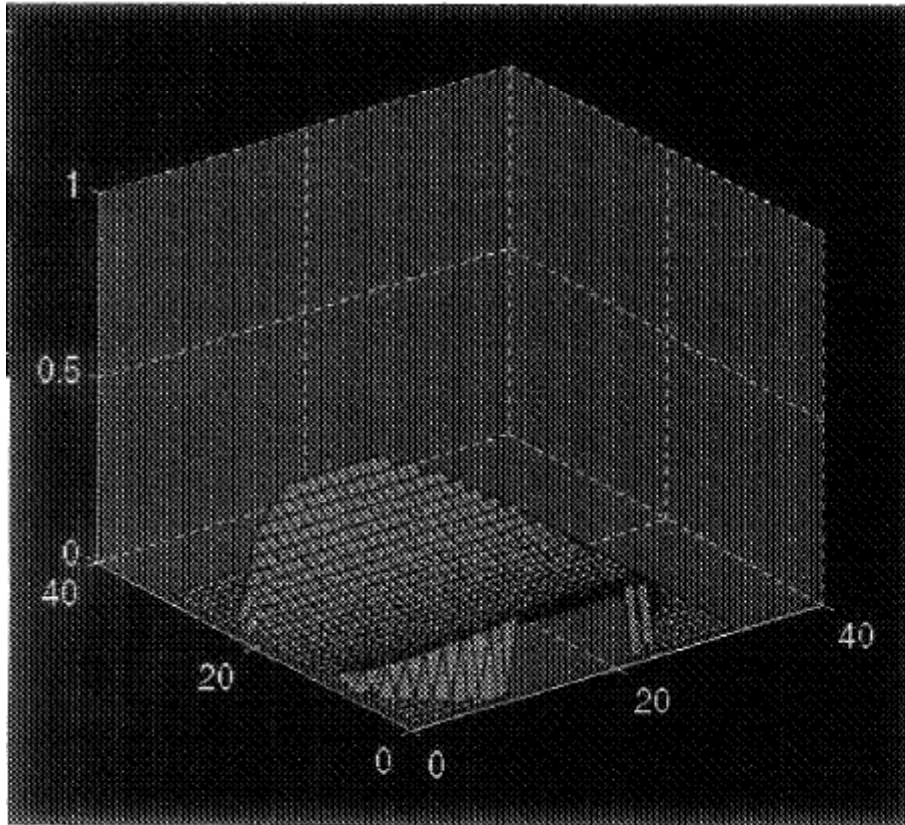


# Coma

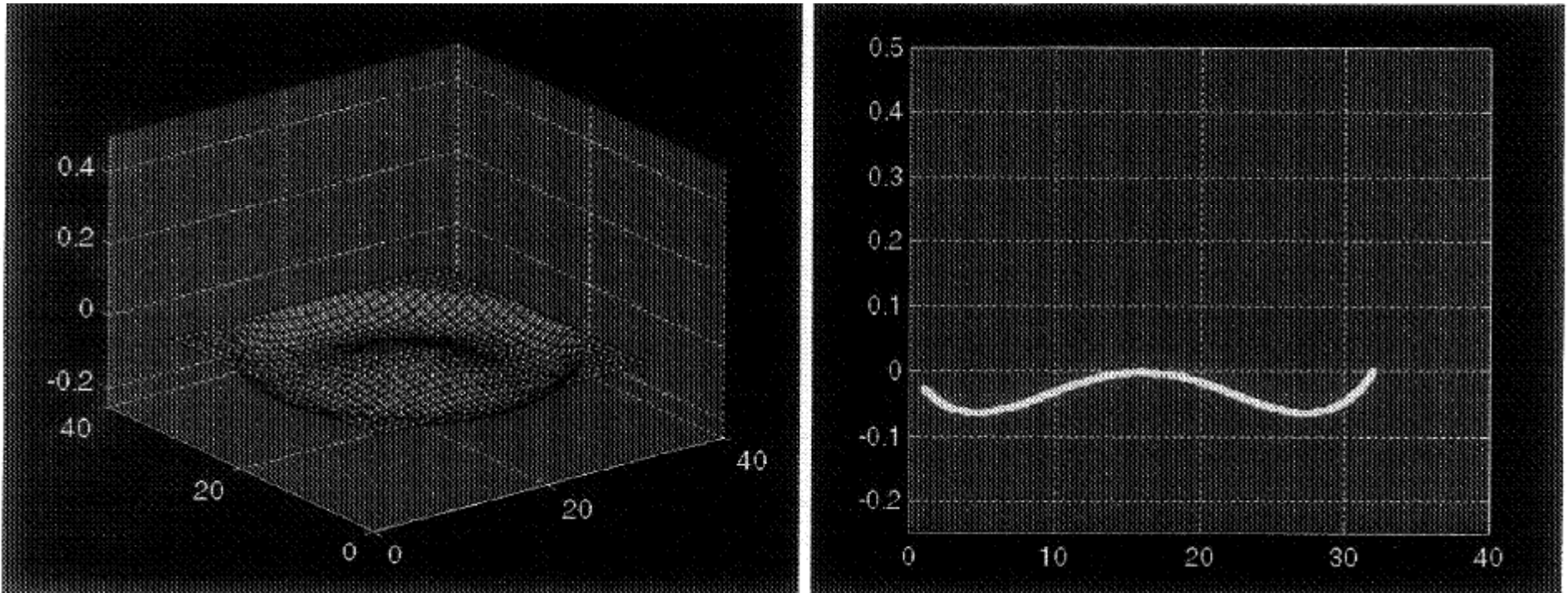




# Astigmatism

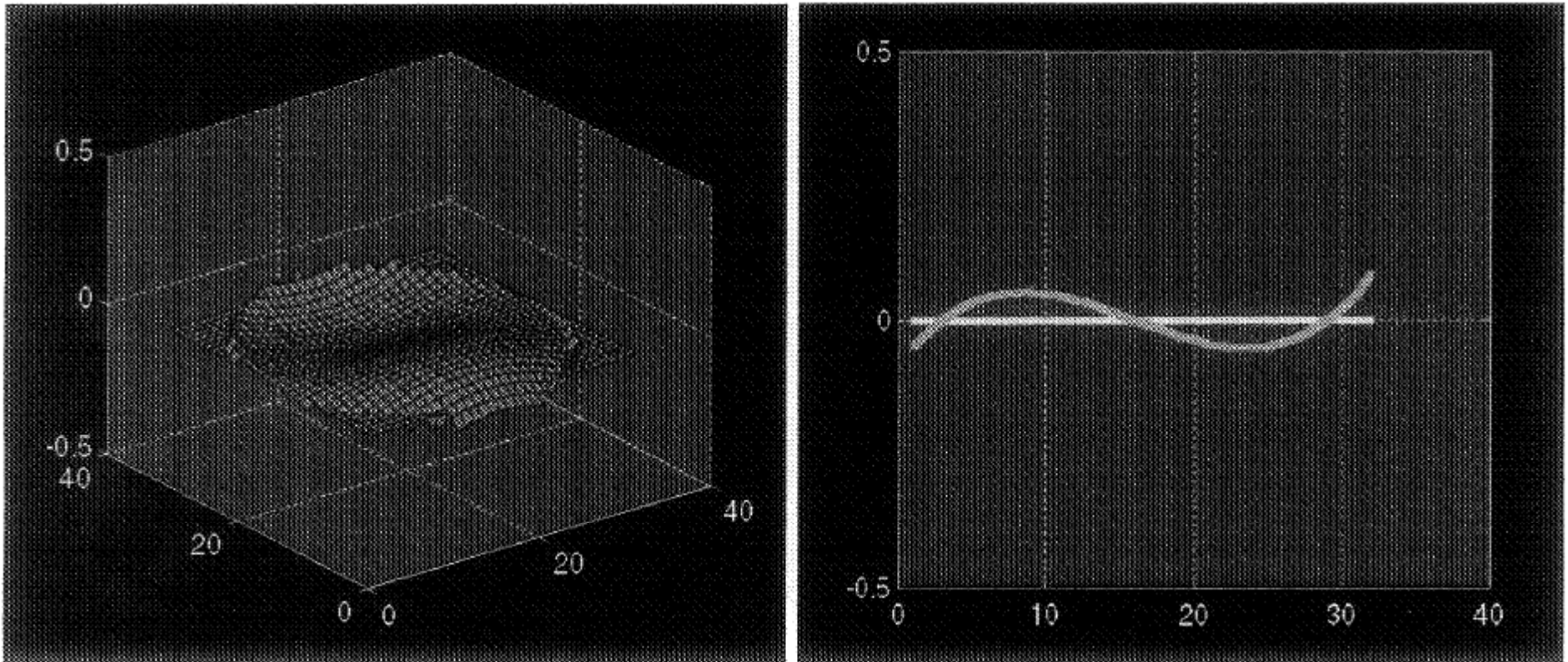


# Balancing Spherical and Defocus



- Optimal combination of Defocus and Spherical Aberrations
- Wavefront variance decreased by factor of 16

# Balancing Coma and Tilt



- Optimal combination of Coma and Tilt Aberrations
- Wavefront variance decreased by factor of 10