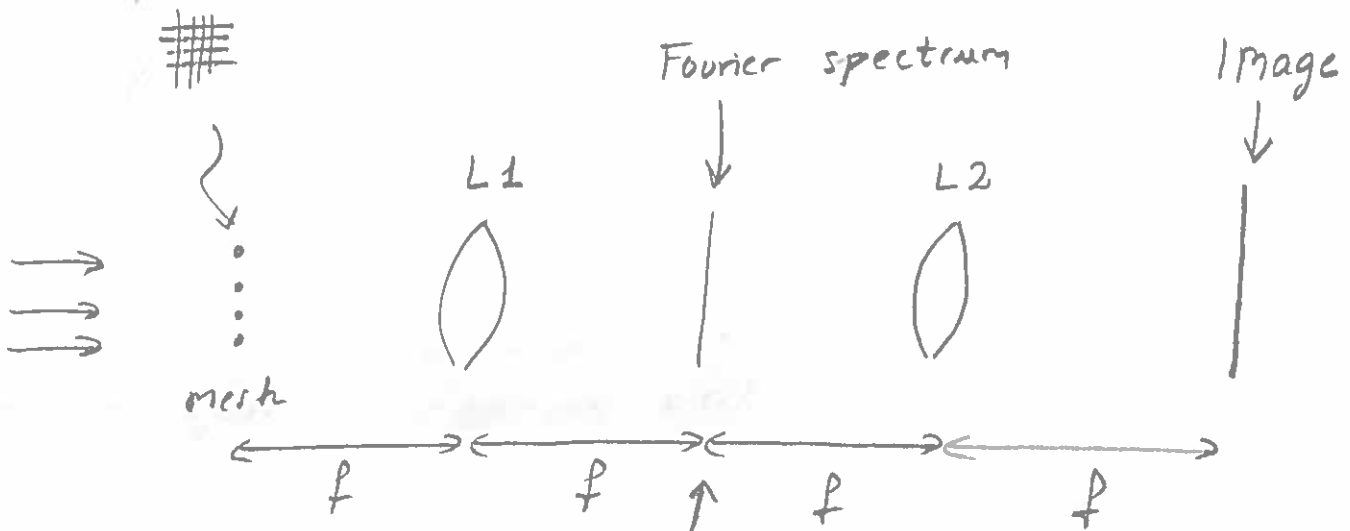


OPTICAL INFORMATION PROCESSING

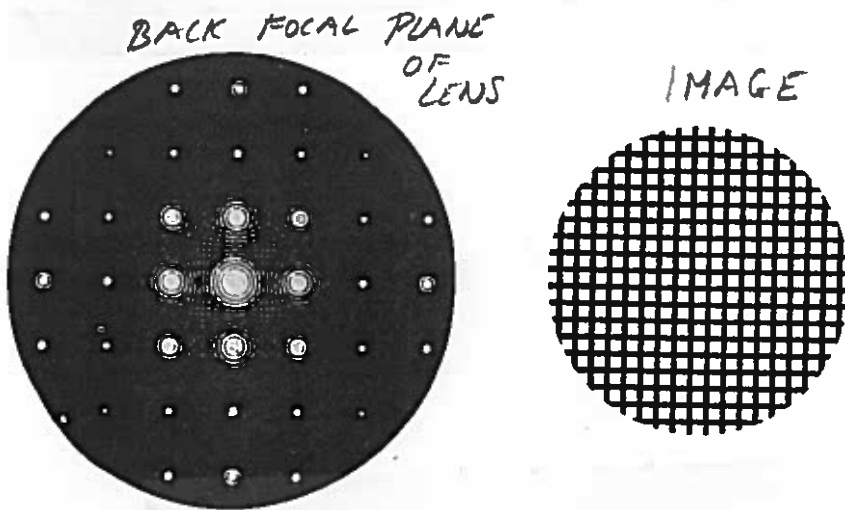
SPECTRAL FILTERING

FOURIER SYNTHESIS

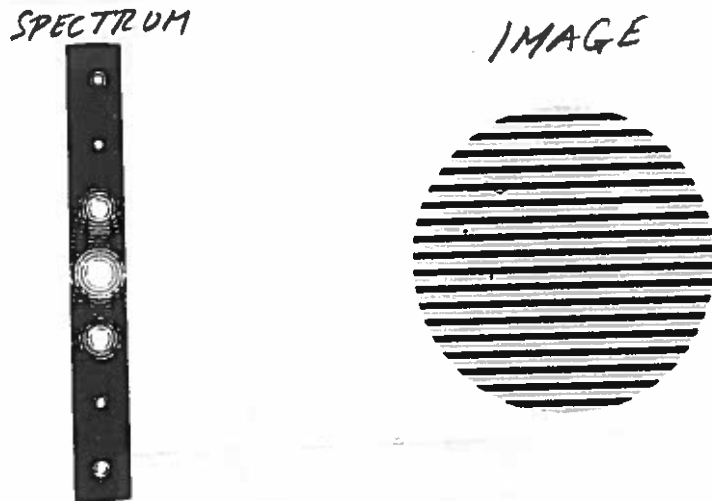
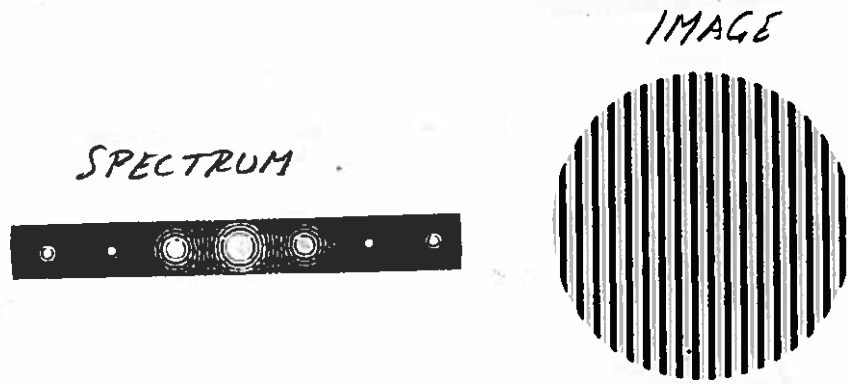
MANIPULATION OF FOURIER SPECTRUM



INSERT SLIT ; OR IRIS :
 OPEN GRADUALLY
 AND WATCH
 IMAGE :
 WATCH FOURIER
 SYNTHESIS OF
 MESH



INSERT SLIT IN FOURIER PLANE:



ZERNIKE PHASE CONTRAST MICROSCOPE

IMAGE TRANSPARENT OBJECTS

like in biology :

PHASE OBJECTS : $\phi(x,y)$

Cannot image with f.ex. camera directly

\downarrow
 $e^{i\phi(x,y)}$

Intensity measurement

1935: Fritz Zernike : Phase contrast method

Image bacteria f.ex.

$$t(x,y) = e^{i\phi(x,y)}$$

For small phase shifts :

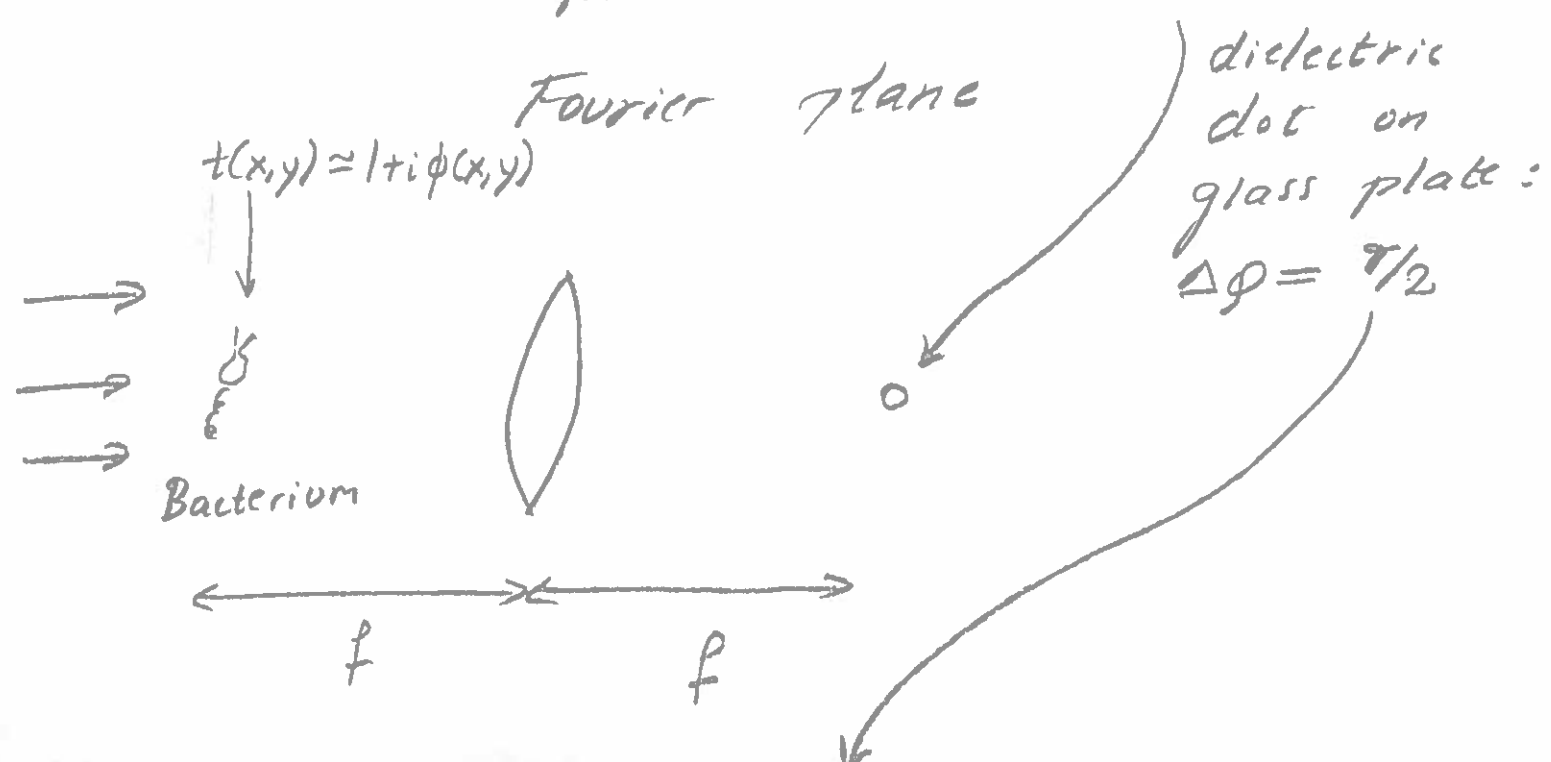
$$t(x,y) \approx 1 + i\phi(x,y)$$

\downarrow in Fourier plane : central spot

\leftarrow deflected in Fourier plane

$$\begin{aligned} \text{Image} &= I_{im} \approx |1 + i\phi|^2 && (M=1) \\ &= 1 + \cancel{\phi^2} \approx 1 && \text{Diffraction Limited} \end{aligned}$$

Zernike : introduced phase shift for 0th order beam in



$$I_i = |1 \cdot e^{i\pi/2} + i\phi(x,y)|^2$$

$$= |i(1 + \phi(x,y))|^2 \approx 1 + 2\phi(x,y)$$

: Spatial Phase Modulation



Spatial Amplitude Modulation