

## **Part 4**

# **Long Wavelength Interferometry**

- **Wavelengths of primary interest**
- **Test infrared transmitting optics**
- **Test optically rough surfaces**

## **Wavelengths of Primary Interest**

- **1.06 microns**  
**Reduced sensitivity**
- **10.6 microns**  
**Reduced sensitivity**  
**Test infrared transmitting optics**  
**Testing optically rough surfaces**

## **1.06 Micron Source Interferometer**

- **Diode Pumped Yag Laser**  
Excellent coherence properties
- **Normal Optics**
- **Normal CCD Camera**

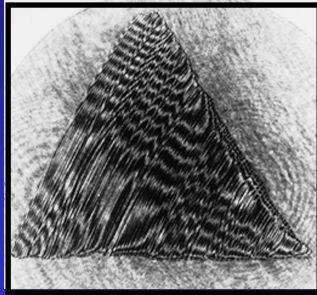
**Conventional interferometry techniques work well.**

## **10.6 Micron Source Interferometer**

- **Carbon Dioxide Laser**  
Excellent coherence properties
- **Zinc Selenide or Germanium Optics**
- **Bolometer**

**Conventional interferometry techniques work well.**

## Reduced Sensitivity Testing



0.633 microns wavelength



10.6 microns wavelength

## Testing Rough Surfaces

Assume surface height distribution is  
Gaussian with standard deviation  $\sigma$ .

The normal probability distribution for  
the height,  $h$ , is

$$p(h) = \frac{1}{(2\pi)^{1/2} \sigma} \exp\left(-\frac{h^2}{2\sigma^2}\right)$$

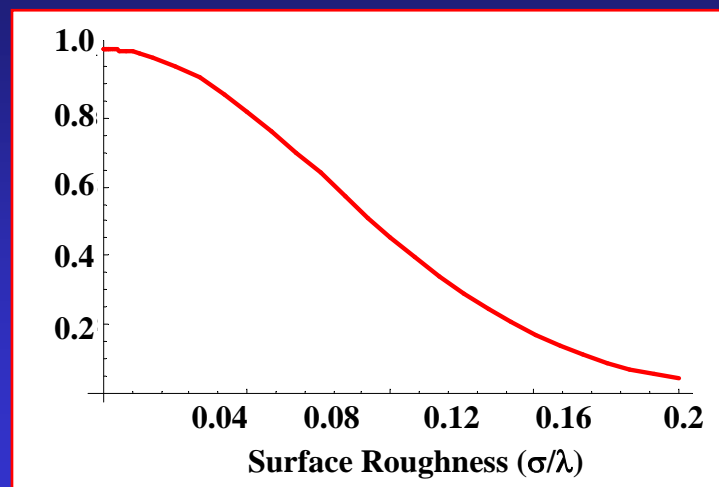
## Fringe Contrast Reduction due to Surface Roughness

The fringe contrast reduction due  
to surface roughness is

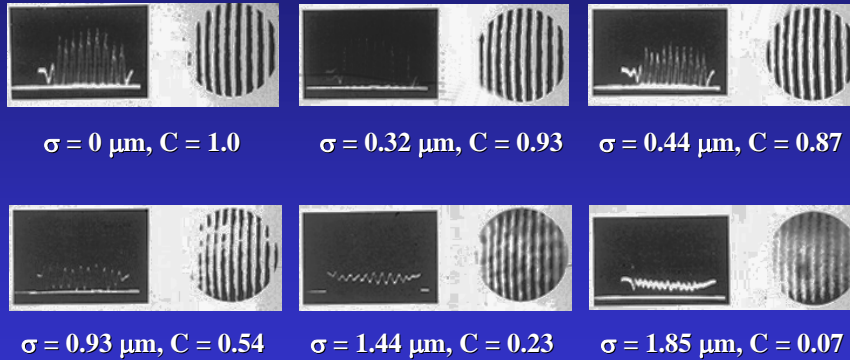
$$C = \exp(-8\pi^2 \sigma^2 / \lambda^2)$$

Reference: Appl. Opt. 11, 1862 (1980).

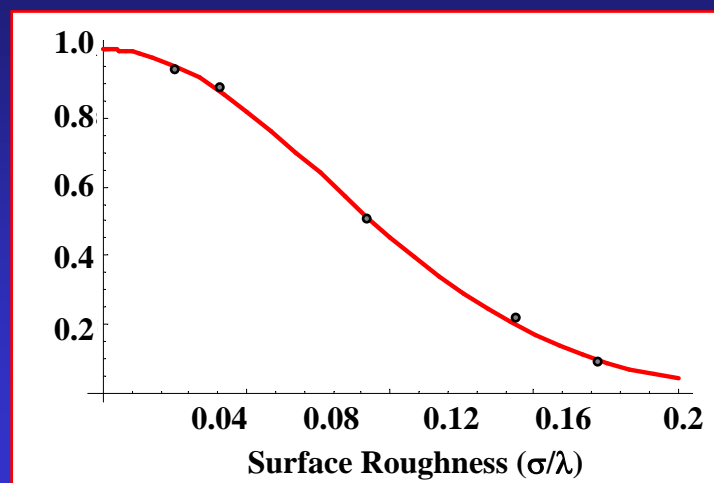
## Fringe Contrast versus Surface Roughness - Theory



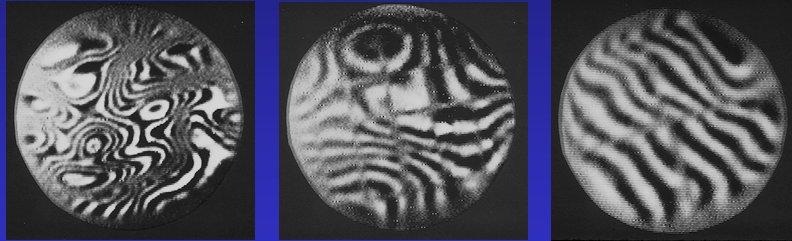
## Interferograms Obtained for Different Roughness Surfaces



## Fringe Contrast versus Surface Roughness - Theory and Experiment



## Infrared Interferograms of Off-Axis Parabolic Mirror in Chronological Order



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## 10.6 Micron Wavelength Interferometer



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