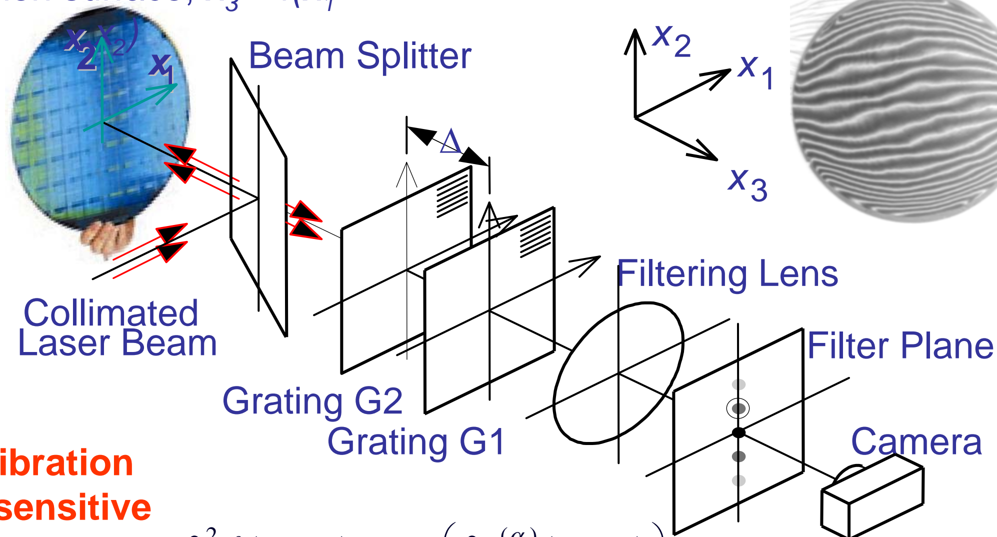
WAFER LEVEL METROLOGY – CGS INTERFEROMETER

Ares Rosakis

Developed at Caltech, the instrument measures full field, wafer curvature by reflecting a 300mm collimated laser beam off the wafer surface, passing it through gratings to generate a self referencing interference pattern. The images on the right are a contour map of the **wafer's slope**. Spacing between fringes generates **curvature**.

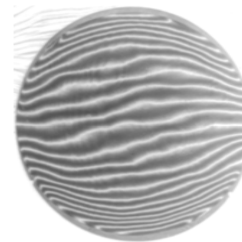
CGS Instrument Schematic*



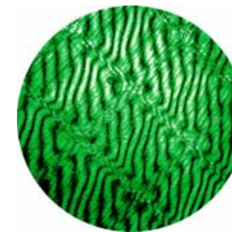
vibration insensitive

$$\kappa_{\alpha\beta}(x_1, x_2) \approx \frac{\partial^2 f(x_1, x_2)}{\partial x_\alpha \partial x_\beta} \approx \frac{p}{2\Delta}\left(\frac{\partial n^{(\alpha)}(x_1, x_2)}{\partial x_\beta}\right), \quad n^{(\alpha)} = 0, \pm 1, \pm 2, \ldots$$

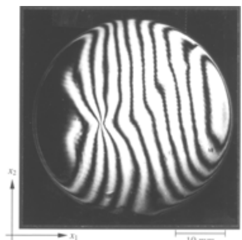
Polished Wafer



Patterned Wafer



Wafer with a problem



The Cleanroom

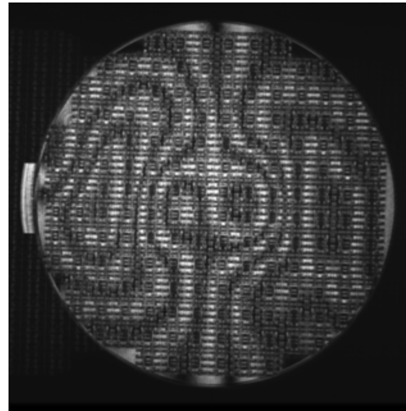
*** U.S. Patent Number: 6,031,611 (Rosakis *et al.*, 2000)**

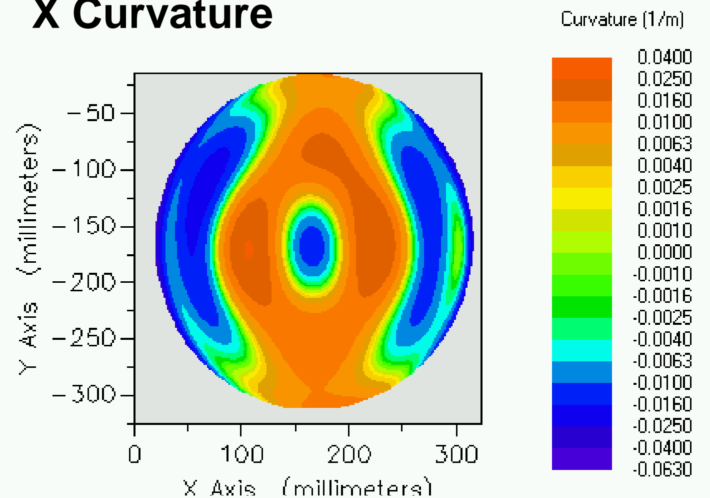
300MM PATTERNED WAFER (CURVATURE MAPS)

Ares Rosakis

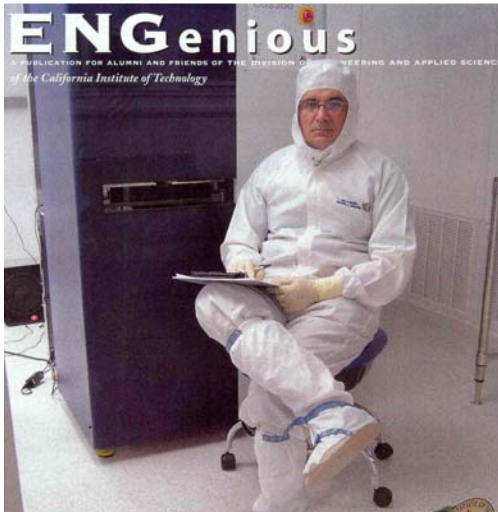
Curvature components are used to estimate film stress maps over the wafer surface

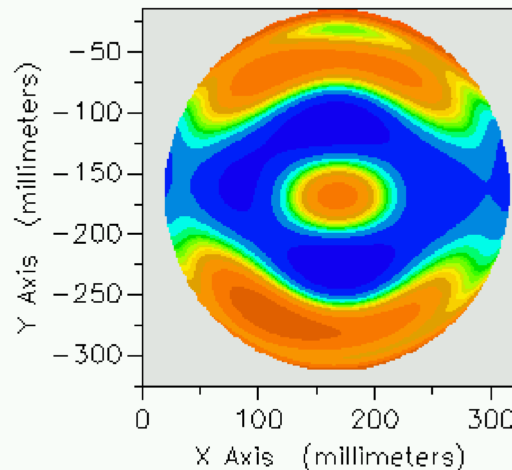
X Interferogram (slope)

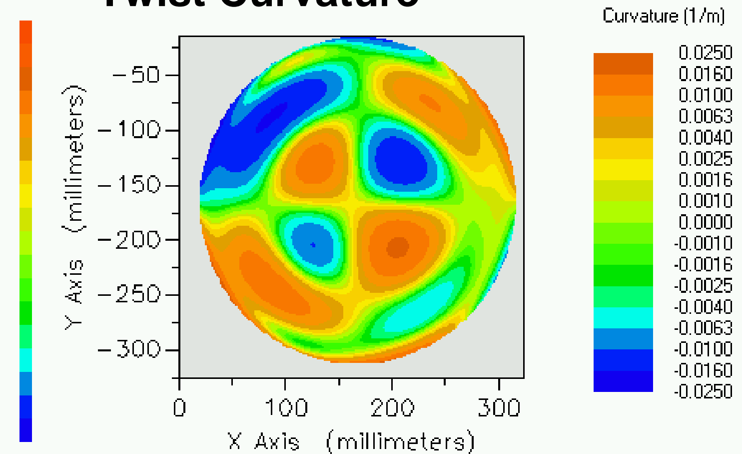




$$K_{11} = \frac{\partial^2 f}{\partial x_1^2}$$

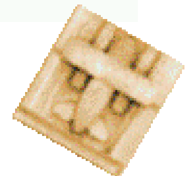






$$K_{22} = \frac{\partial^2 f}{\partial x_2^2}$$

$$K_{12} = \frac{\partial^2 f}{\partial x_1 \partial_2}$$



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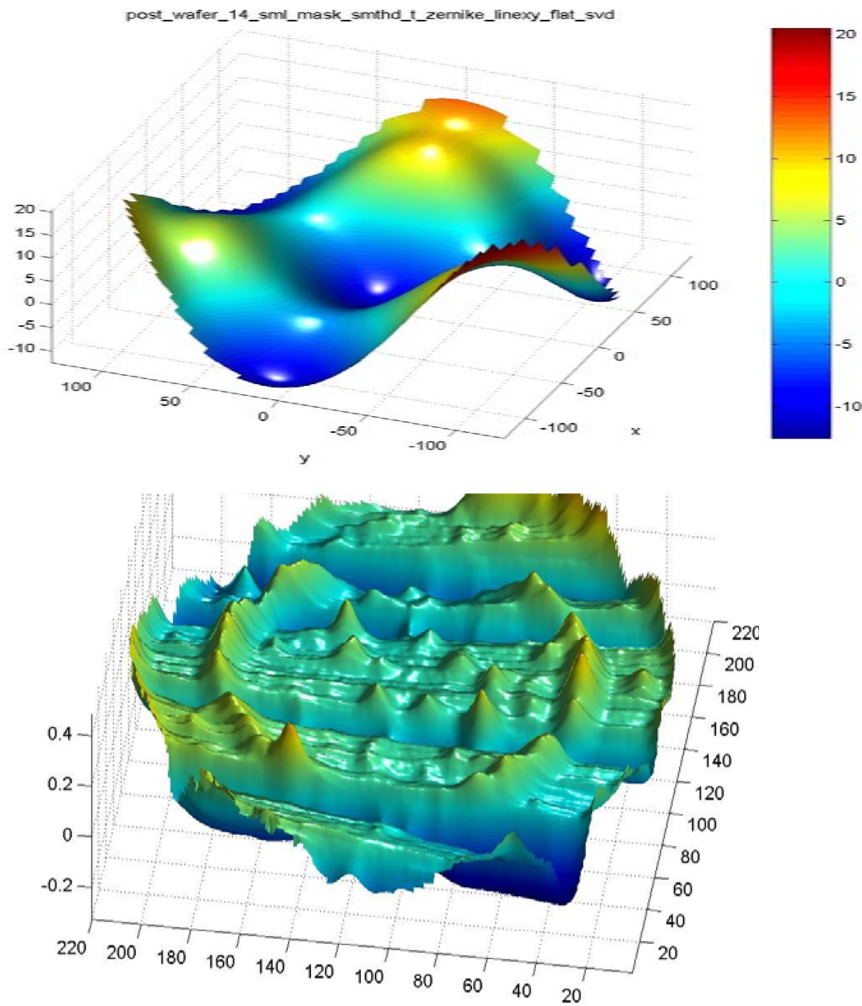
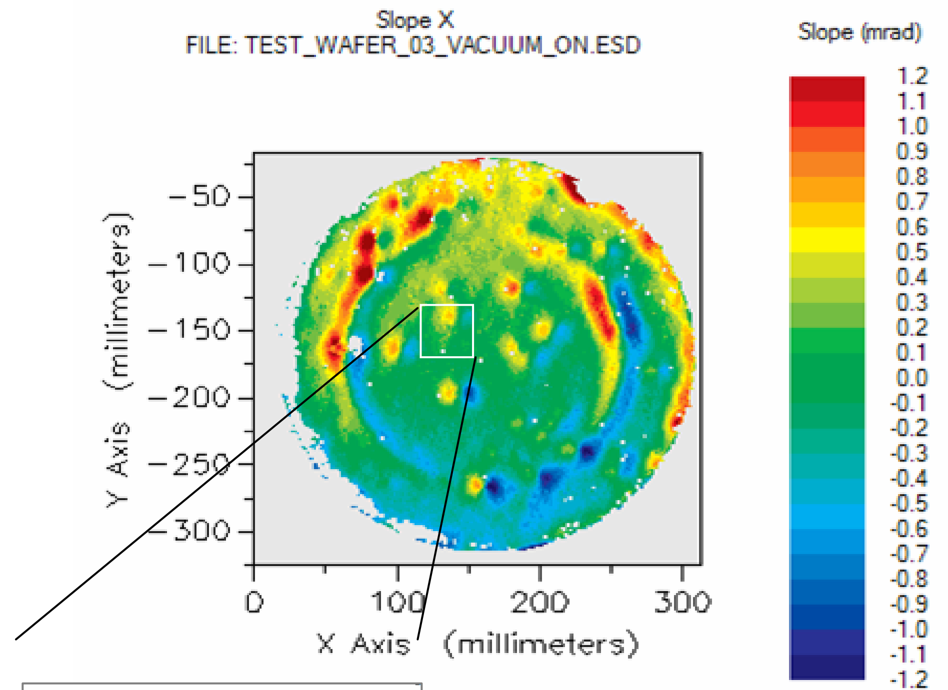
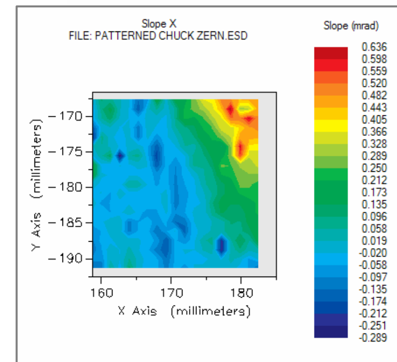
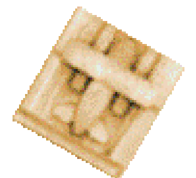
300MM WAFER TOPOGRAPHY FOR LITHOGRAPHY APPLICATIONS







$$\frac{\partial f}{\partial x_1}$$



Topography of a chucked wafer

Slope map (resolution ~ 1μrad)