Figure 4.1: Experimental fringe pattern and theoretical fringe pattern of three point symmetric contact with a load of 200g.

\[(\sigma_1 - \sigma_2) = \sqrt{(\sigma_{xx} + \sigma_{yy})^2 + 4\sigma_{xy}^2}.\]  (4.3)

After substituting the normal and shear stresses in rectangular coordinates, we can rewrite the stress optic law, Eq. (2.1), as

\[n = \frac{Ch}{\lambda} \sqrt{(\sigma_{xx} + \sigma_{yy})^2 + 4\sigma_{xy}^2}.\]  (4.4)

Since the irradiance is a function of the phase difference (see Eq. (2.8)),

\[I = I_0 \sin^2 \left[ \frac{\pi Ch}{\lambda} \sqrt{(\sigma_{xx} + \sigma_{yy})^2 + 4\sigma_{xy}^2} \right].\]  (4.5)

We can then use Eq. (4.5) to plot theoretical images of the stressed disk in Mathematica using a density plot. With these plots, we can attempt to match the theoretical patterns to the experimental patterns. We can use these theoretical plots of fringe patterns to determine the load on the disk by matching the theoretical fringe patterns to the experimental fringe patterns of a loaded disk. Here, we are simply going to compare the images, because analyzing the pictures by pixel proved too tough due to the rough edges and quality of the camera used.

### 4.3 Analysis

Unfortunately, as seen in FIG. 4.1, the plots don’t really look similar to the experimental pictures. It seems that we are missing the circular point in the middle of the picture, the isotropic point, where the principal stresses are equal. Also, it seems that