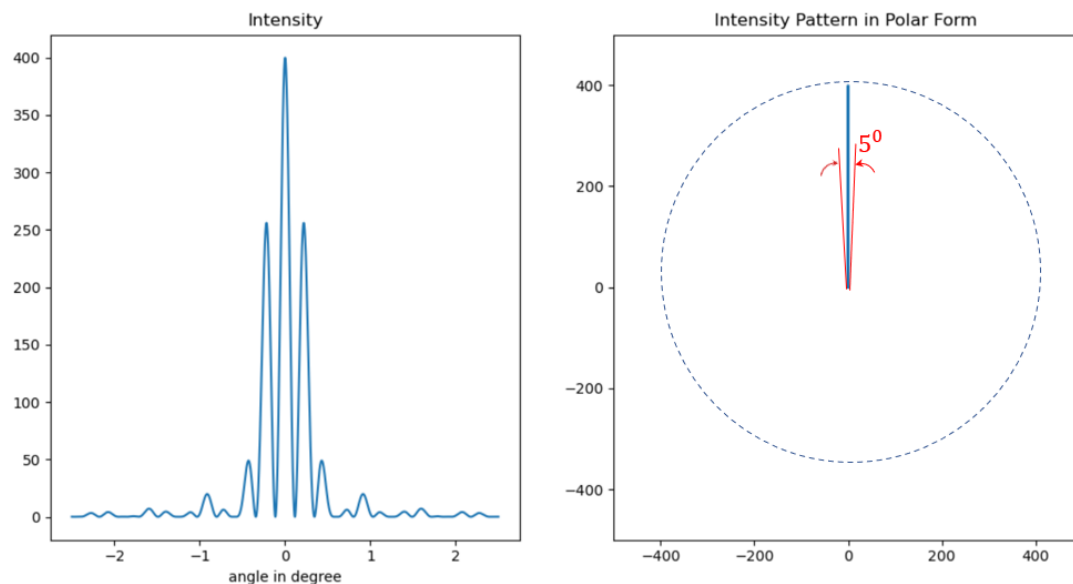


Patterns of Point Source Arrays

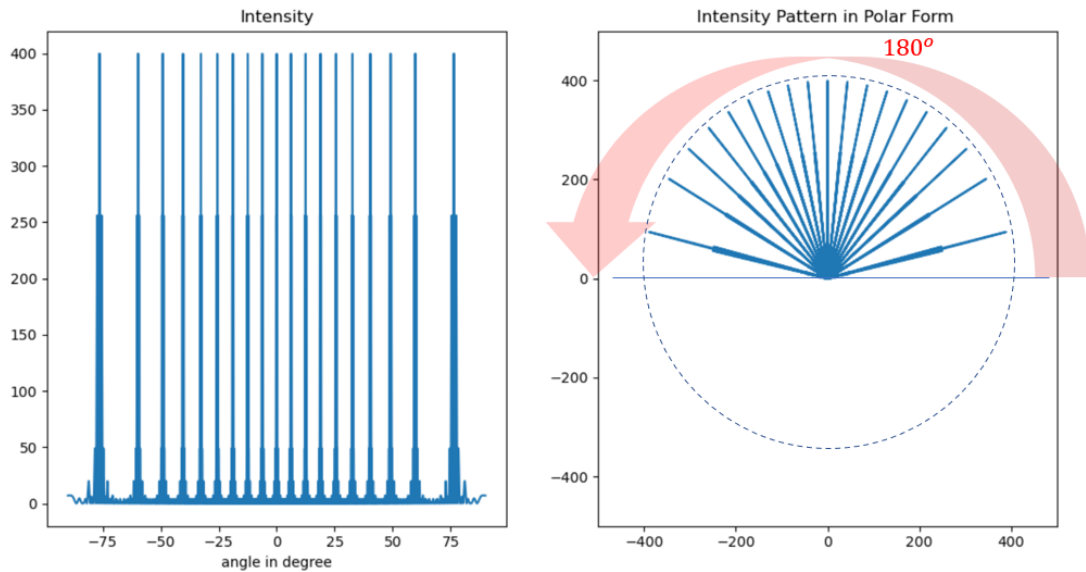
I learned from physics in light grating experiment that light passing through tiny slit(s) disperses its energy into wide-spread rings. Later on, I realized it tries to tell us more than it and implies applications in the opposite.

Both the derivation in textbook and my simulation code view the light segment passing through slits as a line-up, or an array, of point source. Recall a point source disperses its energy equally in every direction. It looks to me that, **by specific arrangement of an array of point source, we could confine their energy in small beam without wide-spreading**, which is sort of an opposite application to the understanding that energy spread due to wave interference. Very interesting! I cannot help but wonder whether we could use that characteristic to steer energy transmission.

The grating pattern plot is usually done in X-Y frame, with X-axis referred to angle and Y intensity. I replot it in polar form, in my simulation code, since it is natural expression for observation involved in angle.

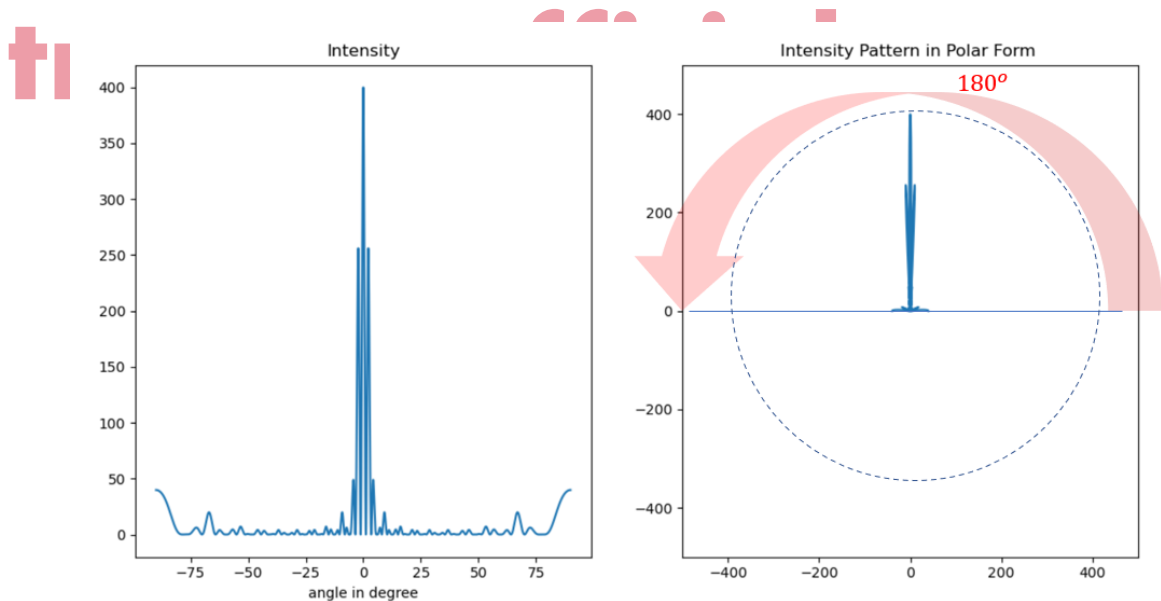


It shows energy does have orientation; or energy distribution is a function of angle. Unlike the derivation in textbook that assumes small θ , my code doesn't put any restriction on θ . Therefore, I run it over (0,180) degree:



It's interesting to observe many replicas over the wide angle. However, the energy is still dispersing in wide sense, which somehow frustrated me.

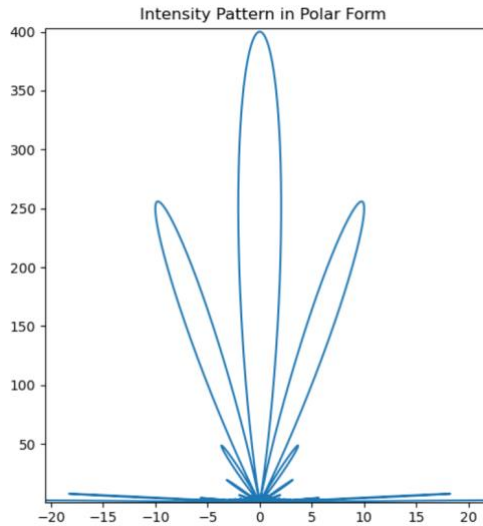
Later when I played around the parameters in my code, tuning the wavelength up by an order, I was surprised to see the following plot



Amazing!

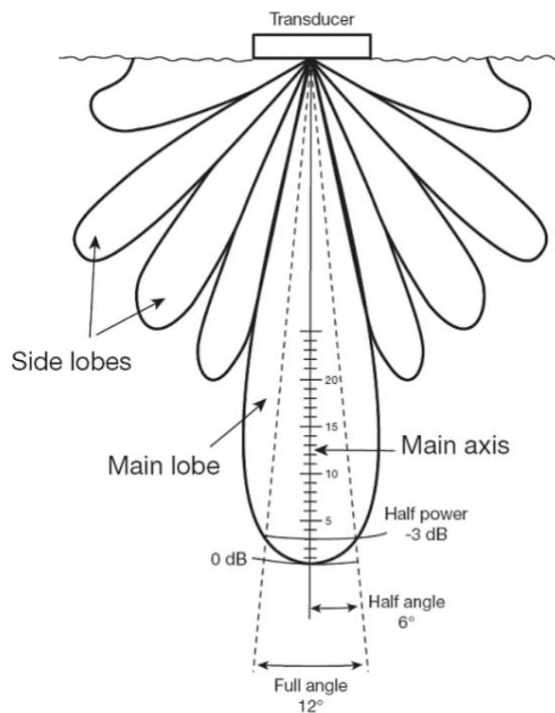
As long as we pay attention to the relation of slit width/spacing and wavelength, the slit and wavelength are around the same order, we can make directional energy flow in narrow beam.

I zoom in the intensity pattern in polar form as below.



It looks very like the beam pattern of acoustic transducer in “Acoustic Unpacked” from Cornell University.

<http://www.acousticsunpacked.org/AcousticBackground/AcousticTransducers.html>



cial.com

It's really exciting to figure out a way to send energy efficiently by waves from one place to another. My further investigation confirms it is the very concept of antenna.