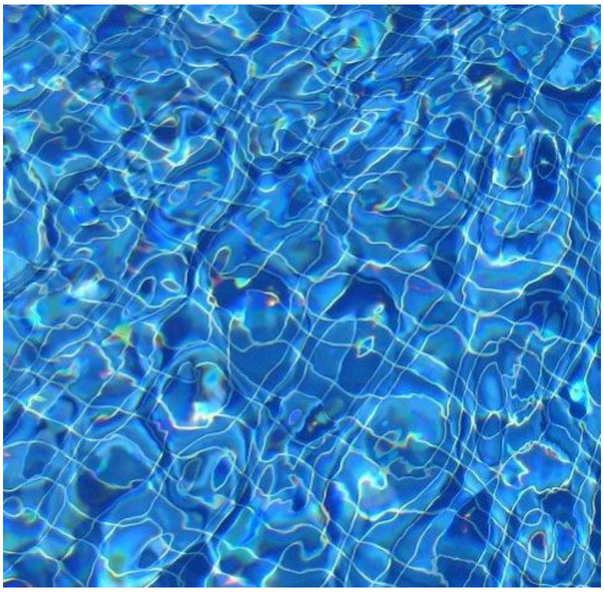
2.1.3 Contrast Theory

A small dislocation loop contained in a thin specimen will produce some "black-whit" contrast if imaged under dynamical two-beam conditions.
Whatever that means. Let's look at an every-day live example:



Bottom of swimming pool containing a rectangular whiter grid

Look at the bottom of a swimming pool when the sun is shining. It looks like that above. The structure at the bottom (here a white line grid) is distorted and you have strong "black-white" contrast. What you see is caused by the wavy structure of the water surface; it will also change all the time.

- If you are a good theoretician you might be able to calculated what kind of water surface produces a picture as shown. If you have a feeling that it won't be all that easy, you are right.

In a general way, the image of small dislocation loops under some conditions follow the same principle. If we want to obtain properties of the dislocations loop from those "black-white" images, we need to consider the basics first. The parameters to take into account are:

1. The *normal vector* of the loop (giving the orientation of the loop plane in the specimen)
2. The *Burgers vector* of the loop (look it up)
3. The *diffraction vector* used for imaging.
4. The size of the (generally small) loop
5. The depth position in the specimen
6. The thickness of the specimen

- The last three points are not so important, they just modulate the principal result somewhat. It's the three vectors that lead to lengthy equations.

I could show that replacing the first two vectors by a "mean" vector, sort of the average of the two, creates almost the same kind of contrast but with considerably shorter and easier equations. In the age of powerful computers that is not a big achievement but back in he time of slide rule calculations it was helpful.

- Here is the relevant publication once more

13 WILKENS, M, .FÖLL, H.**: The black-white vector I of small dislocation loops on TEM images. Phys. Stat. Sol. (a) 49 (1978) 555**
Since this is a theoretical paper, there are no TEM pictures involved.