**Generation of nanoporous gold images in python**

I used concept of wave interference and randomness sponge-like structure of porous gold as suggested in this paper (Acta Materialia 149 (2018) 326e340).

Imagine ripples or waves in a pond created when you drop multiple stones randomly. The waves overlap and create complex patterns of peaks (high points) and troughs (low points). Imagine the pond waves analogy but now extended into 3D space. Instead of waves just spreading on a surface, they extend in all directions (x, y, and z). As multiple waves interfere in 3D, they create regions where they constructively and destructively interfere, forming peaks and valleys in all directions.

In this method, instead of water waves, I use mathematical waves (called sinusoidal waves) that vary randomly in direction and phase (timing of the wave). This randomness simulates the natural, irregular formation of pores in gold when it’s dealloyed (processed to remove some parts, leaving a porous structure) (ref).

Once the 3D waves are generated, we apply a threshold to define solid and pore regions. Points in space where the wave pattern value is above a certain threshold become "solid" (representing gold), and points below the threshold are "pore" (representing empty spaces).

In the process of binarization, I converts the wave patterns into a 3D map with solid regions (gold ligaments) and empty spaces (pores). By setting a cutoff level, I define all areas above a certain value as “solid” and all areas below as “pore” (empty space).

The final 3D structure mimics the real, intricate structure of nanoporous gold, where the solid parts are like a network of tiny connected rods, and the pores are spaces between them.