

# Homology of Level Sets

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The following images are generated by a haskell library I am writing for applied topology. The first step is to generate the level sets using the [marching cubes algorithm](#), which I've implemented in haskell. Then next part is to compute the persistent homology via left or sub level set filtration; this also includes ideas from large scale geometry.

## Barnes et al.

Julie Barnes, William Krehling, and Beth Schaubroeck published a [Coloring Book of Complex Function Representations](#). This coloring book has several pretty images generated via level sets of complex valued functions. Since the book is available for purchase, I thought the images in the book needed [barcodes](#); hence my interest in the project.

And here is a [pdf](#) of the image with its barcode generated by left level set filtration.

## Batman Logo

This image looks strikingly similar to the Batman Logo.

And here is a [pdf](#) of the image with its barcode generated by left level set filtration.

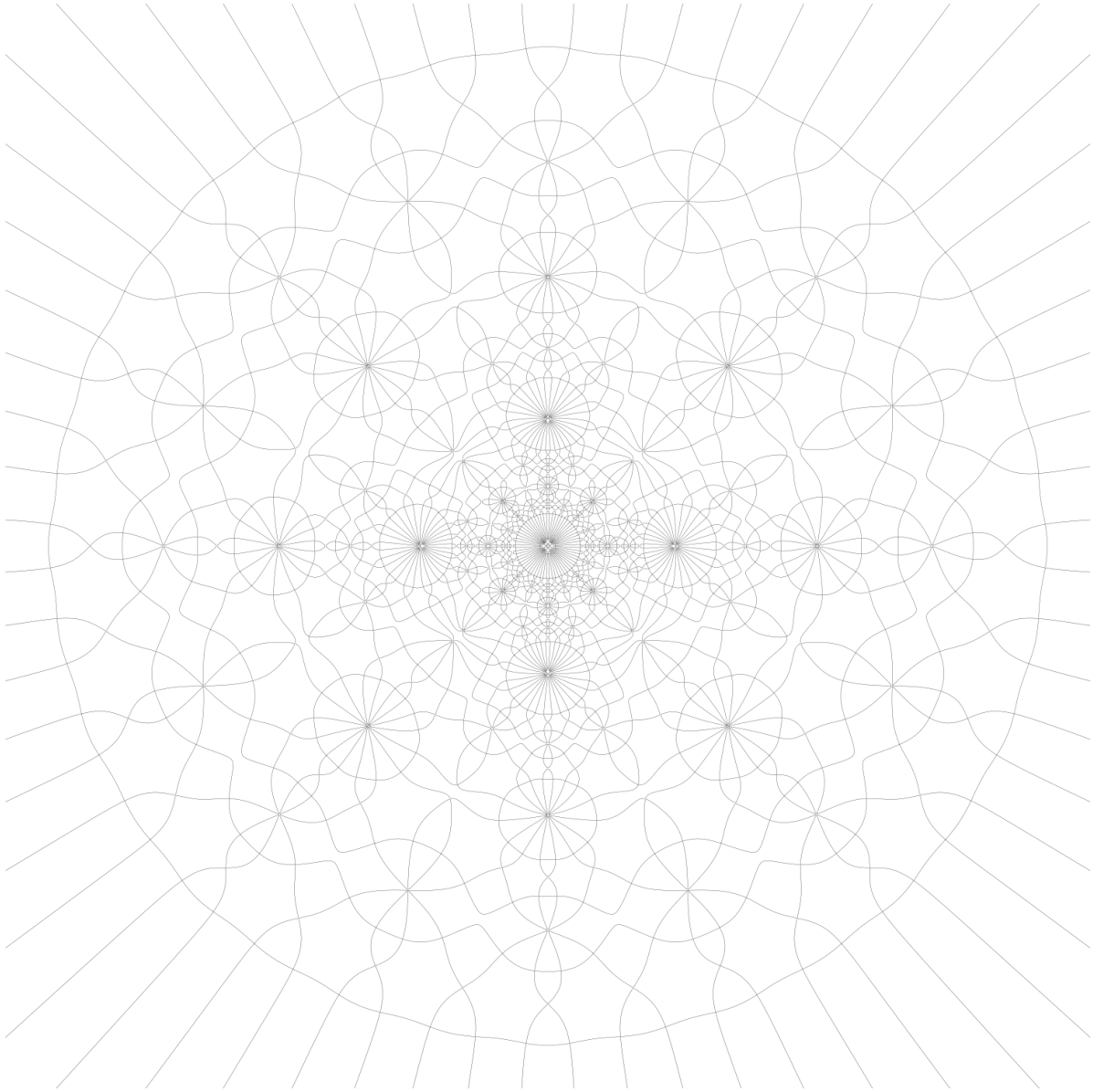


Figure 1: Plate 3 from the book by Barnes et al. Let  $f(z) = z^2 - 0.003/z^2$  and  $g(z) = \Re(f^5(z))$ .  
The image is  $g^{-1}(0) \cap [-1, 1] \times [-1, 1]$ .

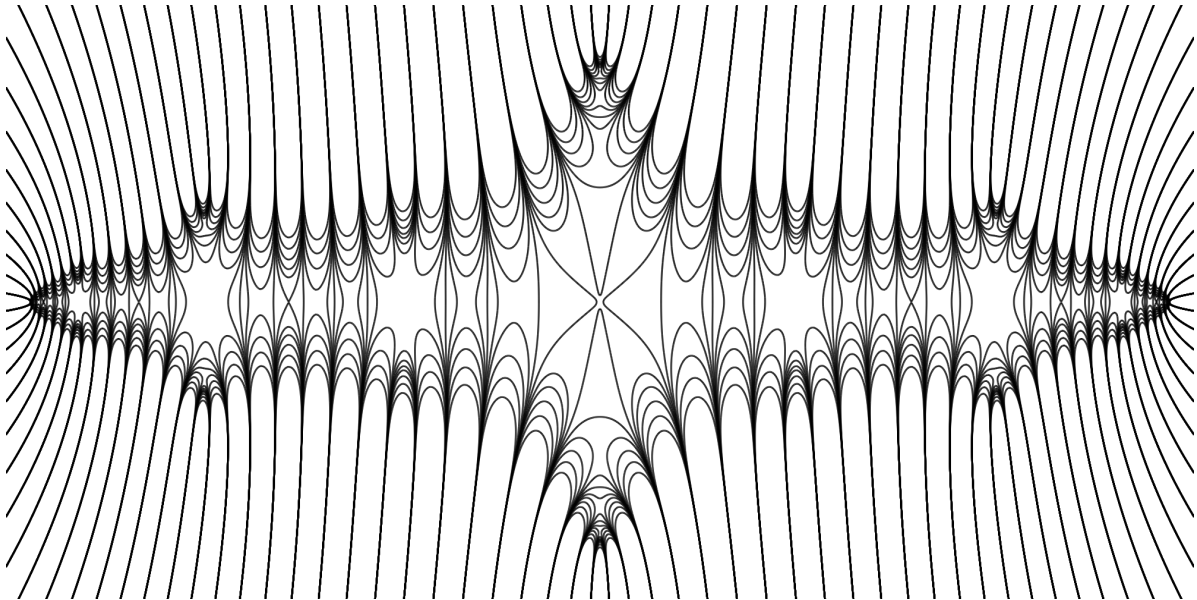


Figure 2: Let  $f(z) = z^2 - 1.75488$  and  $g(z) = \Re(f^6(z))$ . The image is  $g^{-1}(\{\pm 0, 1, 2, 4, 8, 16\}) \cap [-2, 2] \times [-1/2, 1/2]$ .