

The Beauty of Roots

SGColin

October 11,2019

The Shiyan School Attached to Shijiazhuang NO.2 Middle School

Contents

1. Complex Number
2. Visualisation
3. The Beauty of Roots
4. Wander

Complex Number

Complex number

$$z = a + bi$$

a is the real part.

b is the imaginary part.

i is the solution of " $x^2 = -1$ "

Unsolvable equation

$$(x + 1)^2 = -9$$

Is this a unsolvable equation?

Since the even power of a real number can't be negative.

Solve it!

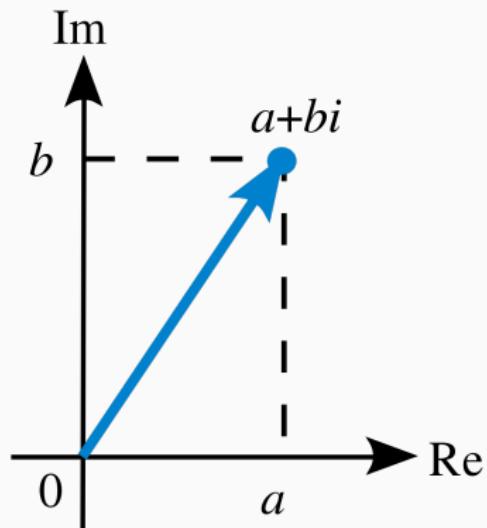
Solution is $-1 + 3i$ and $-1 - 3i$.

This can be verified using the fact that $i^2 = -1$

Visualisation

Coordinates Express

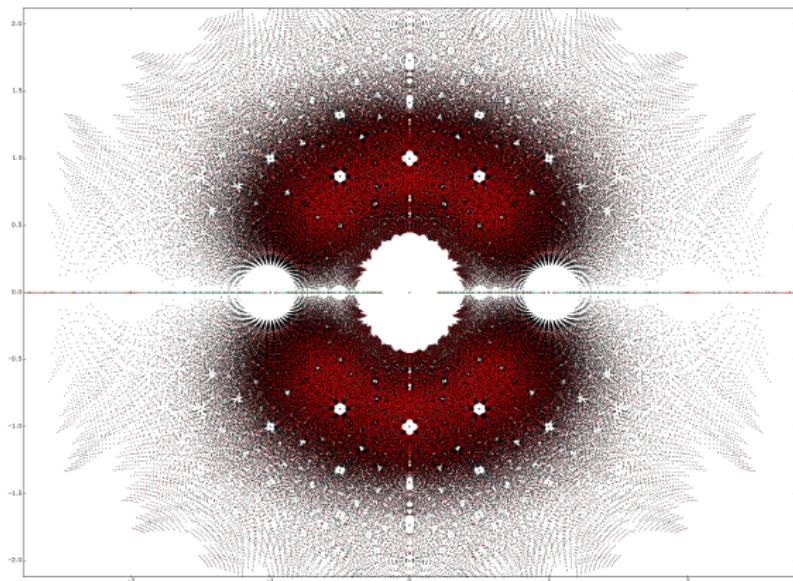
z can be identified with an ordered pair: $(\text{Real}(z), \text{Imaginary}(z))$



The Beauty of Roots

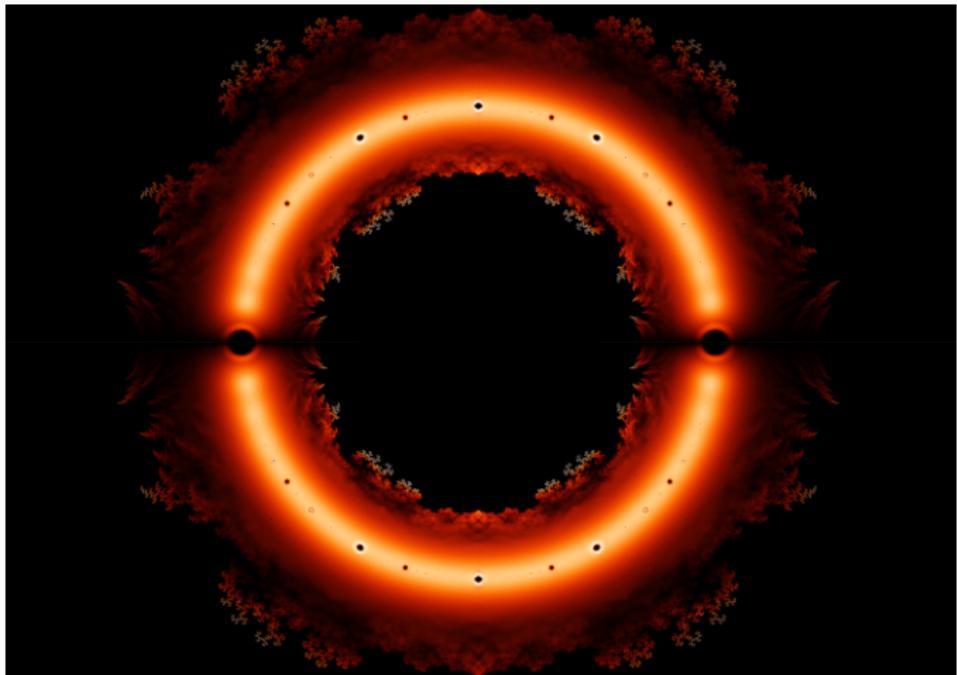
Picture 1

This is the picture of all the roots of all polynomials of degree 5 with integer coefficients ranging from -4 to 4:



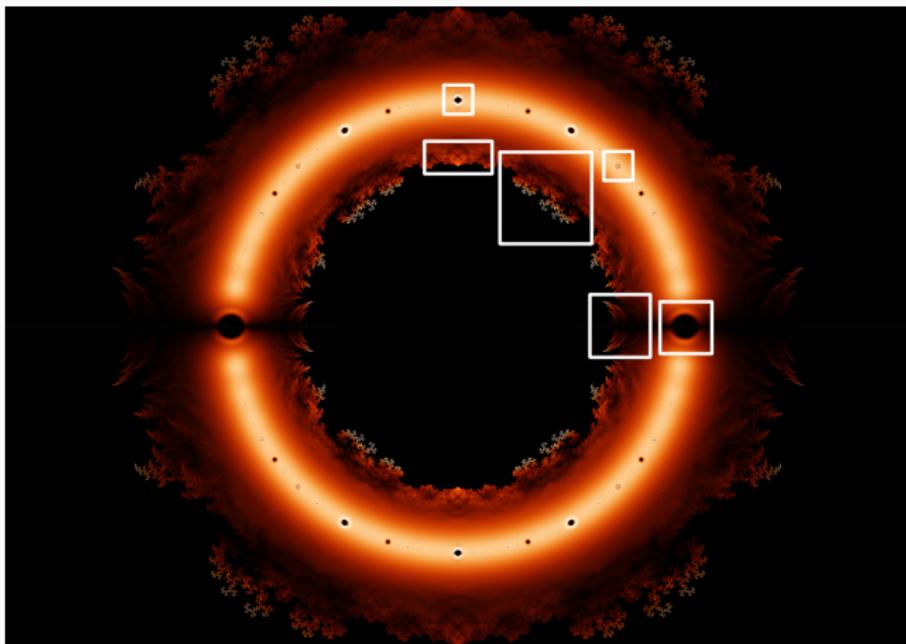
Picture 2

This is all the roots of all polynomials of degree ≤ 24 .



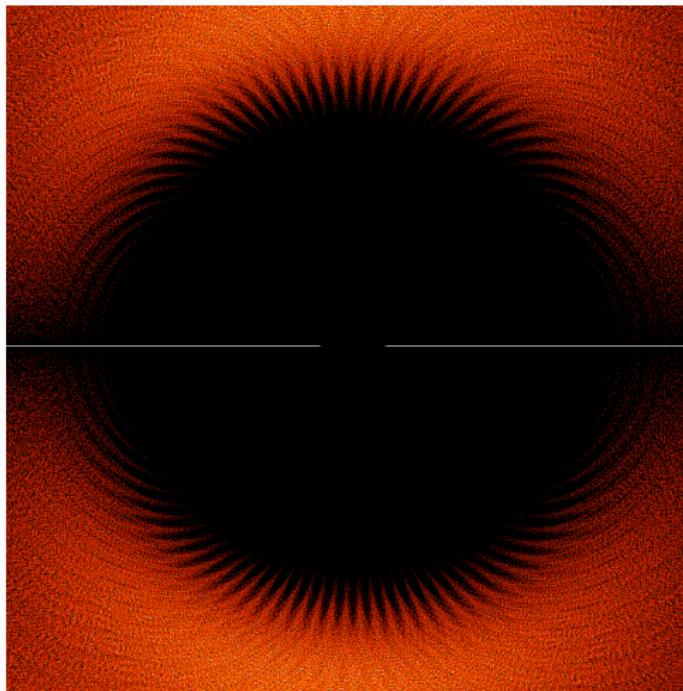
Zoom in

We can zoom in to get more detail:



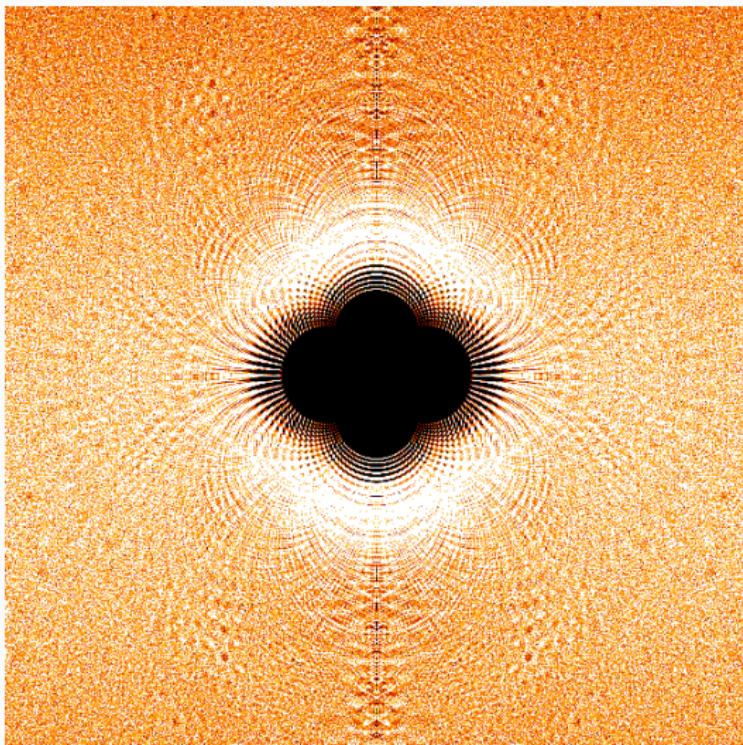
Picture 3

Here's a closeup of the hole at 1:



Picture 4

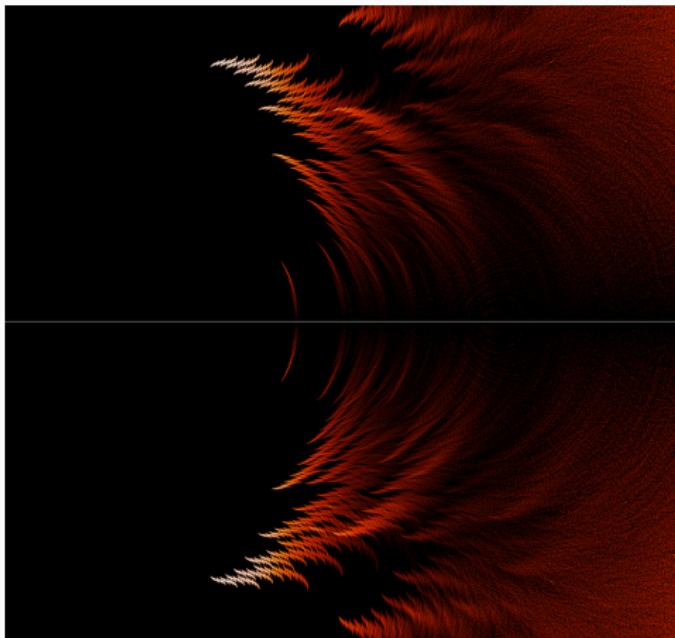
Here's a closeup of the hole at i :



Picture 5

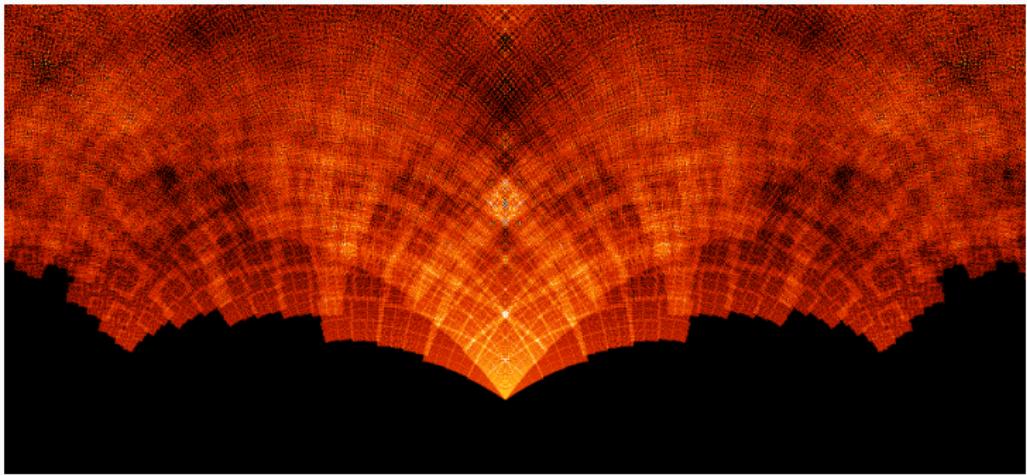
But the feathery structures as move inside the unit circle are even more beautiful:

This picture is centered at the point $4/5$:



Picture 6

They have a very different character near the point $(4/5)i$:



Wander

Summary

Thanks for listening.

QQ: 2679864609

Email : 2679864609@qq.com

Blog : blog.gyx.me

Made by \LaTeX

