

# Ross Summer Academy

## #5: Chaotic

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# Exemplary Units

- Five mentalities:
  - R: aRithmetic, from dot
  - G: Geometric, from 3500 BCE (grade 5)
  - A: Algebraic, from 800 CE (grade 8)
  - D: Dynamic, from 1600 (grade 9)
  - X: Chaotic, from 1889 (grade 11)

# X threads, grs 11-12

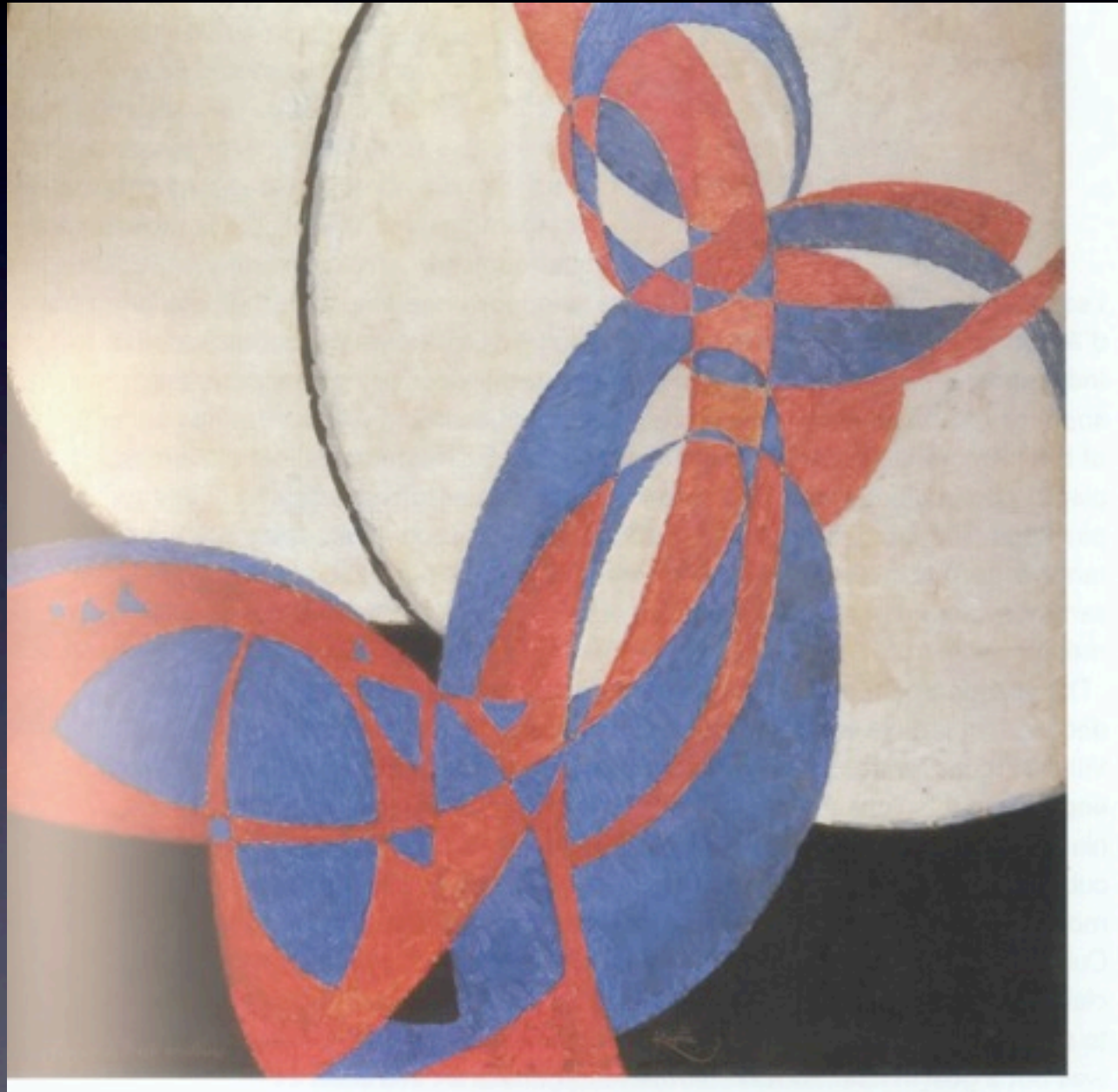
- X1. Poincare, 1889
- X2. Kupka, 1912
- X3. Julia, 1920
- X4. Ueda, 1961
- X5. Mandelbrot, 1975



# XI. Poincare, 1889

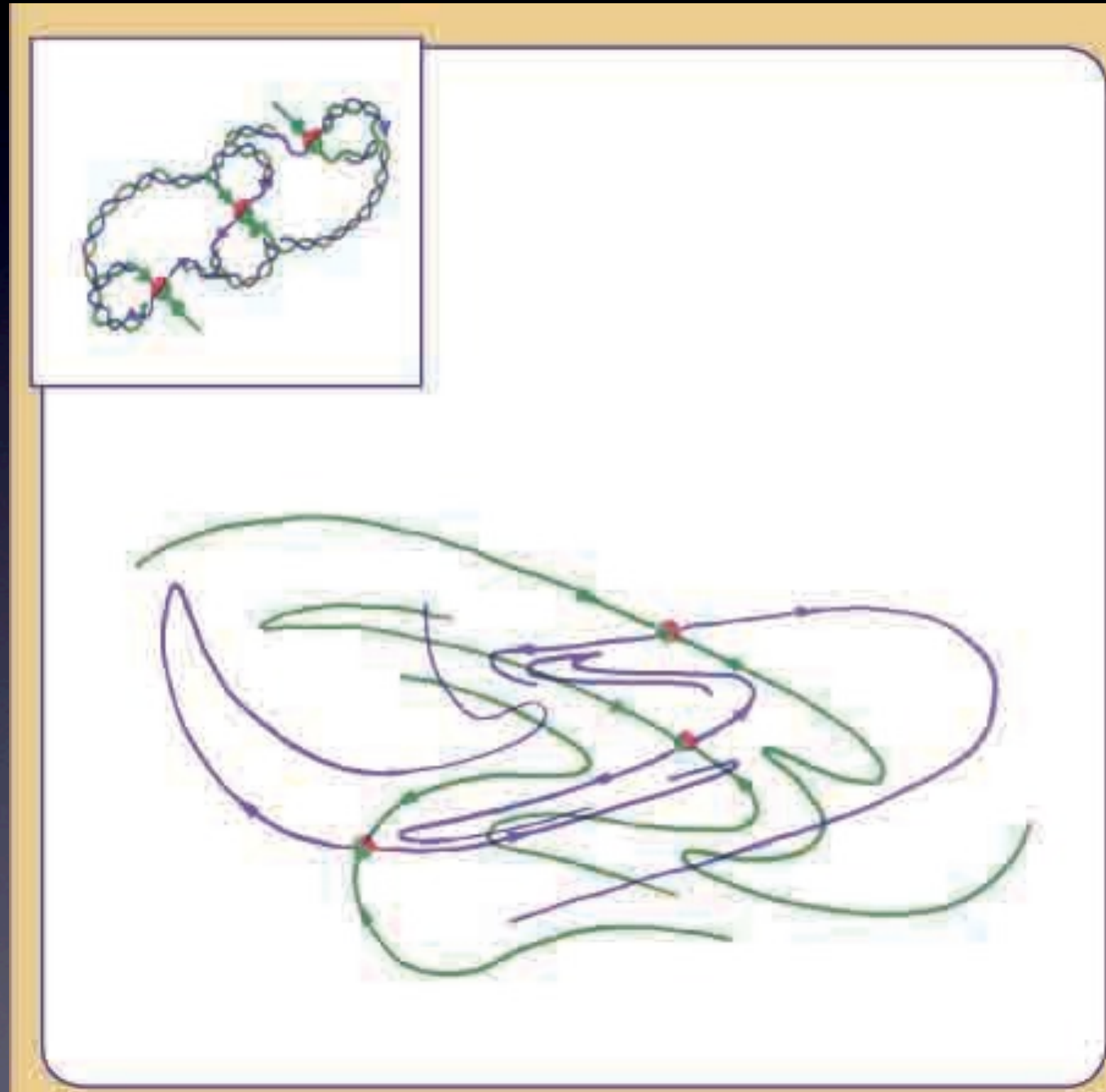
- Studied stability of the solar system
- Prize paper, mistake found
- Fixed the mistake, discovered chaos
- Too difficult to draw

# X2. Kupka, 1912





# X4. Ueda, 1961

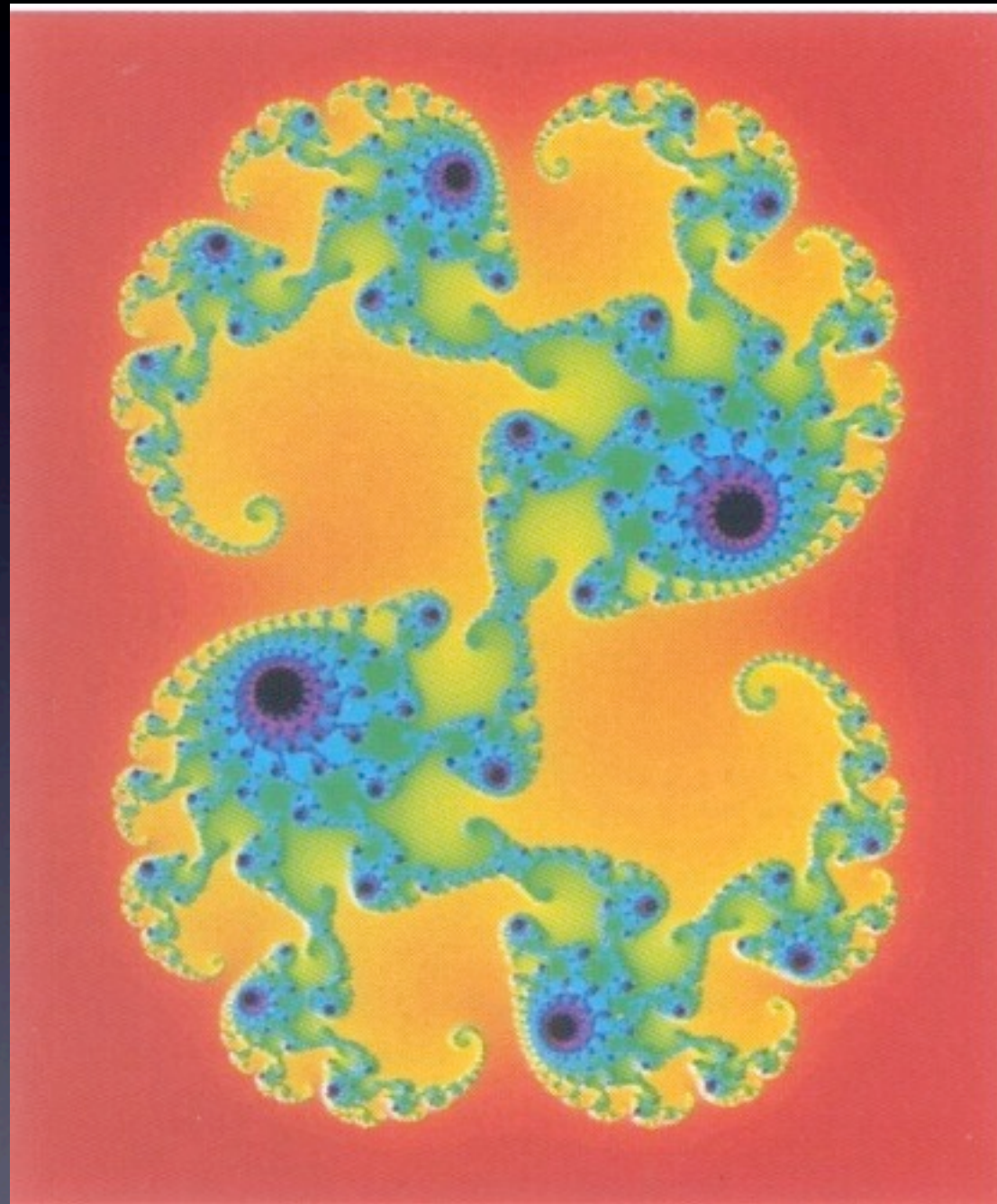


# X3. Julia, 1918

- Discovered attractor at infinity
- Another in the center
- Basin boundary:  
Too complicated to draw



# X5. Mandelbrot, 1975





# The End

- For more, see:
  - [www.ralph-abraham.org/ross](http://www.ralph-abraham.org/ross)