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STRUCTURE AND LIFE IN THE MANDELBROT-SEAS

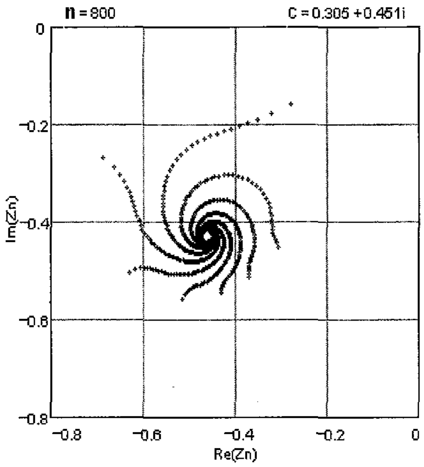
LAJOS KECSKÉS

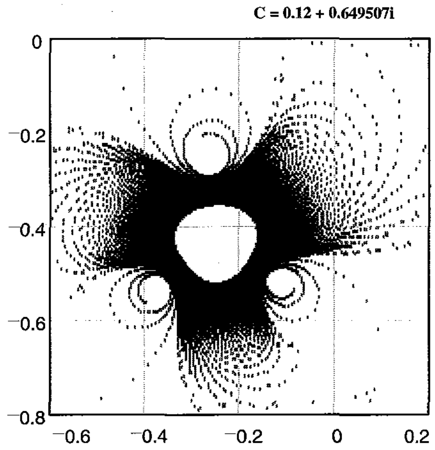
Name: Lajos Kecskés (b. Szolnok, Hungary, 1944).
Address: Erd• u. 21. Solymár, 2083 Hungary *E-mail:* lalyos@netposta.net
Fields of interest: (cosmology, astronomy and philosophy)
Awards: Teacher of chemistry and physics: 1967. Engineer of chemistry, 1975.
Publications: *Egy ölnyi végtelen,* [One Fathom Infinite, in Hungarian], Budapest: Nemzeti Tankönyvkiadó, 2002. (Book); Egy ölnyi végtelen, *Természet Világa*, 2002, page 267 (Article).

Abstract: *The most famous and known fractal is the so called Mandelbrot-set. It can be given by a very simple iterative mathematical formula:* $Z_n = (Z_{n-1})^2 - C$*. The points of this fractal form a curiously limited shape on the plane of the complex numbers. We can imagine the largest spot as a „sea", and the smaller ones as "bays" of this "Mandelbrot-sea". The depth of this water hides curious mathematical miracles: the arrangement of these bays can come into contact with the series of the Fibonacci-numbers, with the structure of electron-clouds inside of atoms and even with the biological laws of the genetics. Changing the exponent of the equation arises the multitude of mandelbrot-seas containing more or less, or – maybe it is unimaginable – "negative" symmetry axis's. Inverting (mirroring?) the role of the variable and the constant of the Mandelbrot-equqtion occurs a new mathematical pattern: extral.*

1 MAELSTROMS AND BUBBLE-BEINGS

Consecutive iteration of the Mandelbrot-equation creates curious and surprising formations on the plane of the complex numbers. Here you can see two of them: from the point of $C = -0.305 + 0.451i$ originates a seven-armed maelstrom, but for example in the point of $C = 0.12 + 0.649507i$ "lives" a "triaxial bubble-being". Its symmetry – similarly to the biaxial symmetry of the true terrestrial animals – isn't perfect, but it is clear.





The number of the bubbles forms a difficult but surprisingly regular structure. Similarly to the structure of the electron-clouds and quantum-numbers inside of the atoms, every bay can characterize by four numbers, depending on the numbers and shapes of the bubbles and the maelstroms. Between any of two bays lies no end of other bays, but the largest of them contents the sum of the number computable from the numbers of the bubbles of the original two bays.

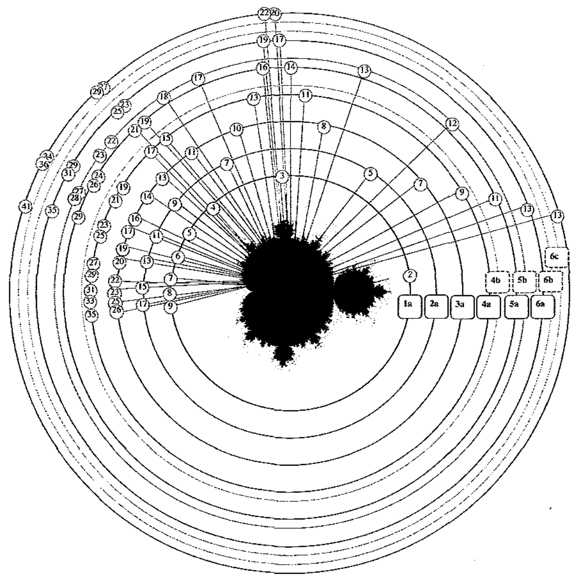
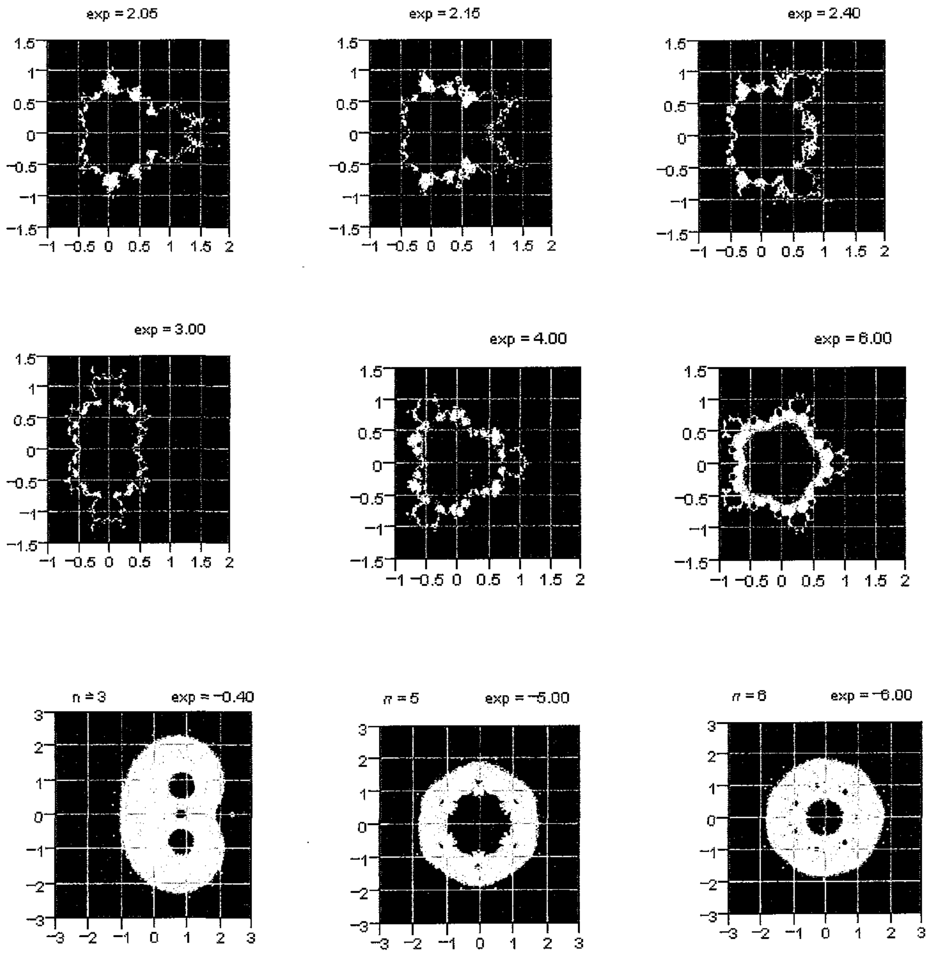


Figure 1:

Structure of the bays of the Mandelbrot-sea.

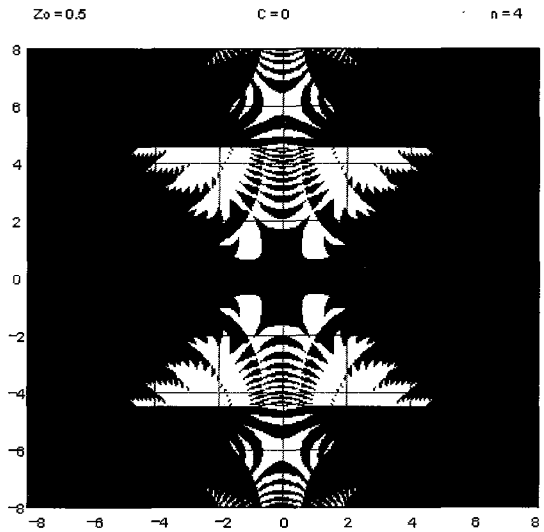
2 SEGMENTATION OF THE SEA

Using fractional numbers between 2 and 3 in the exponent (instead of "2") the sea "rives" (like the Red sea in the Bible). In the case of whole numbers new symmetry axis's appear, and to the negative exponents belong totally different symmetries:



3 EXTRALS

Changing the role of the exponent and the constant C, we can create (not create, only find: these formations exist even without us) new mathematical patterns on the complex plane: let's coin them as "extral" (= extraordinary fractal). Here is one of them:



References

Barrow, John D. (1994) *A fizika világképe*, Budapest: Akadémiai Kiadó.
Barrow, John D. (1998) *A művészi világegyetem*, Budapest: Kulturtrade Kiadó.
Bengi, László (2003) Kecskés Lajos: Egy ölnyi végtelen, *Szépirodalmi Figyelő*, p. 118.
Falconer, K. (1990) *Fractal Geometry, Mathematical Foundations and Applications*, New York: Wiley.
Fokasz, Nikosz (1999) *Káosz és fraktálok,* Budapest: Új Mandátum Könyvkiadó.
Gleick, James (1999) *Káosz,* Budapest: Göncöl Kiadó.
Mandelbrot, Benoit (1983) *The Fractal Geometry of Nature,* W. H. Freeman, Company, New York.
Peitgen, H.-O. and Richter, P. H (1984) *The Beauty of Fractals*, Berlin: Springer.
Muraközy, Gyula and Tél, Tamás (1993) A káosz: rendezetlenség, struktúra, komplexitás, Magyar Tudomány, *No. 4.*
Penrose, Roger (1993) *A császár új elméje*, Budapest: Akadémiai Kiadó.
Perneczky, Géza (1992) *Mire jó a fraktálfilozófia?* Köln: Authors's edition.
Stewart, Ian (1995) *A természet számai,* Budapest: Kulturtrade Kiadó.
Szabó, László Imre (1997) *Ismerkedés a fraktálok matematikájával*, Szeged: Polygon.
Tél, Tamás and Gruiz, Márton (2002) *Kaotikus dinamika*, Budapest: Nemzeti Tankönyvkiadó.
Tél, Tamás (1984) Törtdimenziós rendszerek: a fraktálok, *Természet Világa*, 115.
Vicsek, Tamás (1989) *Fractal Growth Phenomena*, Singapore: World Scientific.