



Applications of Physics in Financial Analysis
conference announcement: Fresh ideas on the behaviour of markets and other phenomena in economics are currently being drawn from other disciplines. In particular, the emerging subject of 'econophysics', based on the techniques of statistical physics, is attracting widespread attention. The increasing availability of advanced computing facilities has added a further dimension to this rapid development, and created new job opportunities for mathematics and science graduates.

A landmark conference on this exciting interdisciplinary subject is to be held at Trinity College Dublin, Ireland, 15 to 17 July 1999. It is supported by the European Physical Society, together with its new Division of Statistical Physics and Nonlinear Phenomena, and other Groups. *local contact:* James Sexton, Maths Department, Trinity College, Dublin *email* sexton@maths.tcd.ie *EPS contact:* Christine Bastian, Conference Secretary, EPS, BP 2136, F-68060 Mulhouse Cedex, France *email* c.bastian@univ-mulhouse.fr *programme info:* Preben Alstrøm, Niels Bohr Institute, Kobenhavns Universitet, Blegdamsvej 17, DK-2100 Copenhagen O, Denmark *email* alstrom@nbi.dk

Left A prototype for the generation of fractal structures. A particle diffuses with a brownian motion. As it touches the cluster's border it stops and sticks. Then a new particle is introduced, and so on. This simple iterative process spontaneously generates very complex fractal structures. The cluster here shown corresponds to an aggregate of 50,000 particles. Different colours indicate different aggregation times.
Courtesy of B.B. Mandelbrot and C. Evertsz

The Great Fractal Hunt

Last March, 11 European research teams formed a network to probe the edges of order and disorder and search for fractal dimensions, selforganization and the sources of complex structures.

The research teams are looking in a startling variety of places – propagating cracks, forest fires, glass forming liquids, galaxies, musical instruments, meandering rivers, neural networks and nuclear waste, for instance. In the words of one research team leader, "theoretical physics has never before seen such an extensive project."

The network was put together by Luciano Pietronero, of La Sapienza University in Rome, by connecting 35 of the best statistical physics researchers in Europe and uniting them with a 1.8 million Ecu grant from the Training and Mobility of Researchers funding scheme of the European Union. "For a totally theoretical enterprise it is quite a lot," he says. "It consists mostly of money for postdocs – 15 postdocs – plus money to travel and to coordinate." The network is to run for four years.

Pietronero's own group will be looking at the distribution of galaxies. When they look at the universe they see fractal structures, and not the homogeneity in galaxy distribution that others see. A fractal or an homogeneous universe? It's currently an open debate.

Groups are also based in Naples, Munich, Oslo, Cambridge, Geneva and Fribourg. One of two groups in Paris, at the Ecole Polytechnique, led by Bernard Sapoval, is to look at the interaction between vitrified nuclear waste and water. And also car and train tunnels – would a tunnel with an irregular 'fractal' profile help to dampen noise?

Per Bak, member of a team at the Niels Bohr Institute in Copenhagen, and co-inventor of selforganized criticality, is to build a brain model that can recognise patterns and then "forget". In his model, neurons are always so close to firing "very small changes can cause a big modification of the way things are connected," he says.

The Spanish team, actually formed of

two groups at the Universities of Barcelona and Alicante and a third group at the Materials Science Institute in Madrid, will apply the concepts of fractality and selforganization to fracture (the effects of viscosity on fracture propagation in solids – crack speed and morphology are affected by viscous forces – and heating at the crack tip), medicine (classifying neuronal cells according to their fractal dimensions, investigating the effects that fractal morphology may have on signal propagation) and quantum systems (the multifractality of the wavefunction in chaotic cavities).

The Spanish team will also be doing some economics (as will other teams), investigating a model of technological advance in industrial competition.

And that's not to mention all of the other subjects the teams will be looking into, and the other places they will hunt for fractals.

Antonio Dobado, the Spanish correspondent for Europhysics News, and Toby Chapman