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Fractal Hierarchy in Isotopic Positional Correlations in Crystals

ALEXANDER A. BEREZIN, McMaster University — From subatomic particles to superclusters of galaxies, nature has nested hierarchial fractal-like organization (R.L. Oldershaw). Earlier I discussed formation of isotopic superlattices due to self organizational dynamics among isotopes (A.A. Berezin, SolidStComm, 1988). Informationally (in spirit of "Maxwell's demon" engine), formation of isotopic superlattices can be inferred from Maximum Entropy Principle (C.E. Shannon, E.T. Jaynes). In spite that effects of gravitation for isotopes (due to their nuclear mass difference) are very small, they can, nevertheless, manifest in such subtle effects as gravitationally-induced reduction (collapse) of wave functions (F. Karolyhazy, R. Penrose, A.A. Berezin). Since Planck mass (which is combination of h, G and c) is about 0.02 mg, size of desired isotopic fluctuation should be about 100 mkm (mesoscipic). Experimentally, isotopic correlations, micron and sub-millimeter isotopic fluctuations, isotopic clusters and isotopic fractal-type distribution can be probed by Rayleigh scattering (sampling at various wavelengths) and/or such high electric field effects as hopping conductivity (B. Ya. Shklovsky) in which isotopic clusters act as trapping or scattering centers. Other aspects of purposeful isotopic structuring (isotopic engineering) include isotopic fiber optics (A.A. Berezin) when core and cladding has varied (step or gradual) isotopic content which causes total internal reflection and light confinement.

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