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Cosmology in One Dimension: Fractal Geometry, Power Spectra and Correlation BRUCE MILLER, Texas Christian University, JEAN-LOUIS ROUET, Universite d'Orleans — Concentrations of matter, such as galaxies and galactic clusters, originated as very small density fluctuations in the early universe. The existence of galaxy clusters and super-clusters suggests that a natural scale for the matter distribution may not exist. A point of controversy is whether the distribution is fractal and, if so, over what range of scales. Here the development of scaling behavior and multifractal geometry is investigated for a family of one-dimensional models for three different, scale-free, initial conditions. The methodology employed includes: 1) The derivation of explicit solutions for the gravitational potential and field for a one-dimensional system with periodic boundary conditions (Ewald sums for one dimension); 2) The development of a procedure for obtaining scale-free initial conditions for the growing mode in phase space for an arbitrary power-law index; 3) The evaluation of power spectra, correlation functions, and generalized fractal dimensions at different stages of the system evolution. A possible physical mechanism for understanding the self-similar evolution is introduced. It is shown that hierarchical cluster formation depends both on the model and the initial power spectrum. Under special circumstances a simple relation between the power spectrum, correlation function, and correlation dimension in the highly nonlinear regime is confirmed.

Bruce Miller
Texas Christian University

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