On the Fractal Dimension of the Solar Granulation

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Fractal dimension analysis may be used to determine whether the solar granulation represents homogeneous, isotropic turbulence in certain ranges of scale. Several attempts have been made to investigate this fractal dimension from white light granulation pictures of high spatial resolution, e.g. Roudier and Muller (1986), Darvann and Kusoffsky (1989), and Karpinsky (1990), who find a critical scale of granule sizes, at which the fractal dimension $d$ changes abruptly.

Using material of "Spektro-Stratoskop" and analysing 42,742 granules, we could confirm the results published earlier, i.e. a fractal dimension of approx. $1.3$ for the small scales and $\sim 2$ for the large scales. However, we find a smooth transition between both regimes. Moreover, a closer inspection of the methods used reveals, that in all analyses the fractal dimension of the granulation at small scales seems to be dominated by technical problems, i.e. the limited resolution of the material, the definition of the granules, and - last but not least - the finite pixel size. Therefore, no inference on the turbulent nature of the granulation at scales below 1.3 arcsec seems possible with this technique.