Color multifractal analysis of city lights from outer space  
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Abstract: Photographs of the lights seen from outer space at night are analyzed. We perform a multifractal analysis in red-green-blue color channels of lights spatial distribution of the largest cities and most populous cities in the World. © 2018 The Author(s)

Photographs of the lights seen from outer space at night are a valuable source of freely available online information of city light distribution (Fig. 1). And since 2012 two new spaceborne imaging detectors may be used for city lighting photometry because they have higher spatial resolution and radiometric precision. Data from these detectors have sufficient resolution to analyze the spatial distribution of light emitted by streetlights, airports, harbors, leisure, stadiums, city centers, etc. We perform a multifractal analysis in every color channel of satellite photographs of the largest cities and most populous cities in the World. We perform an analysis of homogeneity fractal structure, which spans from multifractality to monofractality for RGB color channels. Then we analyze the correlation between the fractality and some city characteristics. An example of our results is shown in Fig. 2.

Figure 1. Some cities at night, seen from the International Space Station.

Figure 2. Relationship between city area of some important metropolis and the fractal dimension of the satellite photograph at night. It shows the correlation between the fractality of the pattern of night lights and city spatial extension.