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A description of Seismicity based on Non-extensive Statistical Physics: An introduction to Non-extensive Statistical Seismology.

Filippos Vallianatos

UNESCO Chair on Solid Earth Physics and Geohazards Risk Reduction, Laboratory of Geophysics and Seismology, Technological Educational Institute of Crete, Chania, Greece (fvallian@chania.teicrete.gr)

Despite the extreme complexity that characterizes earthquake generation process, simple phenomenology seems to apply in the collective properties of seismicity. The best known is the Gutenberg-Richter relation. Short and long-term clustering, power-law scaling and scale-invariance have been exhibited in the spatio-temporal evolution of seismicity providing evidence for earthquakes as a nonlinear dynamic process. Regarding the physics of "many" earthquakes and how this can be derived from first principles, one may wonder, how can the collective properties of a set formed by all earthquakes in a given region, be derived and how does the structure of seismicity depend on its elementary constituents – the earthquakes? What are these properties?

The physics of many earthquakes has to be studied with a different approach than the physics of one earthquake making the use of statistical physics necessary to understand the collective properties of earthquakes. Then a natural question arises. What type of statistical physics is appropriate to commonly describe effects from the microscale and crack opening level to the level of large earthquakes?

An answer to the previous question could be non-extensive statistical physics, introduced by Tsallis (1988), as the appropriate methodological tool to describe entities with (multi) fractal distributions of their elements and where long-range interactions or intermittency are important, as in fracturing phenomena and earthquakes. In the present work, we review some fundamental properties of earthquake physics and how these are derived by means of non-extensive statistical physics. The aim is to understand aspects of the underlying physics that lead to the evolution of the earthquake phenomenon introducing the new topic of non-extensive statistical seismology.

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