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Nonextensivity and universality in the earthquake preparation process in terms of Tsallis statistics

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We suggest that the activation of a single fault by means of pre-seismic electromagnetic emissions (PEME) is well described by recently introduced models for earthquake (EQ) dynamics, which have been rooted in a nonextensive framework starting from first principles. The analysis implies that the activation of a single fault is: (i) a reduced self-affine image of the regional seismicity covering many geological faults, and (ii) a magnified image of the laboratory seismicity by means of acoustic and electromagnetic emissions. Finally, we study whether characteristic signatures emerged in PEME indicating the transition to the last phase of the EQ preparation process. We use the q-Tsallis entropy as a measure of complexity. Tsallis entropy, gives evidence of state changes leading to the point of global instability: it detects the pattern of alterations in the preseismic EM signals and is able to discriminate between "injury levels" of the focal area. Importantly, a significant complexity decrease can be confirmed at the tail of the recorded PEME by means of Tsallis entropy, which is also accompanied by the appearance of persistency. We argue that these footprints may indicate the fracture of the backbone of strong entities that hinders the relative motion of the fault planes.

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