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Recent fracture induced electromagnetic field measurements revealing an Earth system in second order phase transition before the occurrence of significant earthquakes

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A crucial feature observed in the study of fracture induced electromagnetic emissions (EMEs) is the asynchronous appearance of MHz and kHz AE-EM precursors: the MHz EMEs precede the kHz ones: the strong avalanche-like kHz emissions are launched in the tail of pre-fracture emissions. Herein, we focus on the systematically observed precursory MHz EME. We show that both, the MHz EMEs recorded prior to recent significant earthquakes that occurred in Greece and the associated seismic activities came to critical condition a few days before the main shock occurrence. The analyses were performed my means of two independent statistical method, namely, the method of critical fluctuation and the natural time method, both revealing critical features. This results indicates the existence of a strong connection of the MHz EME with the corresponding earthquake preparation process. Accumulated laboratory, theoretical and numerical evidence supports the hypothesis that the MHz EME is emitted during the fracture of process of heterogeneous medium surrounding the family of strong entities (asperities) distributed along the fault sustaining the system. The kHz EME is attributed to the family of asperities themselves.