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Scale-free avalanches in disordered systems of localized charges with long-range Coulomb interaction[1] MATTEO PALASSINI, MARTIN GOETHE, Faculty of Physics, University of Barcelona, Spain — We study theoretically and numerically the charge avalanches created by a perturbation in disordered systems of localized charges with unscreened Coulomb interaction (the so-called electron glass model), in two and three dimensions. Starting from a low-lying local energy minimum, we perturb the system by inserting an extra charge or an extra dipole, and let it relax via one-particle hops until a new minimum is reached. We find that the size distribution of the avalanches created in this process displays generically a power-law tail with an exponent close to the mean-field value 3/2 both in 2D and 3D, without requiring any parameter tuning. We provide a qualitative explanation of these results in terms of the density of states of elementary charge and dipole excitations and the associated Coulomb gap, which shows that the power-law tail arises from arbitrarily long hops, without requiring to assume the existence of a glass phase. Finally, we discuss the experimental relevance of these results and compare our picture to similar scale-free avalanches observed in mean field spin glasses, in which they are are associated to a marginal glass phase.

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Matteo Palassini
Faculty of Physics, University of Barcelona

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