Dynamical patterns of epidemic outbreaks in complex heterogeneous networks ALAIN BARRAT, LPT, Universite Paris-Sud, MARC BARTHÉLEMY, CEA, ROMUALDO PASTOR-SATORRAS, Universitat Politecnica de Catalunya, ALESSANDRO VESPIGNANI, LPT, Universite Paris-Sud and School of Informatics, Indiana University — We present a throughout inspection of the dynamical behavior of epidemic phenomena in populations with complex and heterogeneous connectivity patterns. We show that the growth of the epidemic prevalence is virtually instantaneous in all networks characterized by diverging degree fluctuations, independently of the structure of the connectivity correlation functions characterizing the population network. By means of analytical and numerical results, we show that the outbreak time evolution follows a precise hierarchical dynamics. Once reached the most highly connected hubs, the infection pervades the network in a progressive cascade across smaller degree classes. Finally, we show the influence of the initial conditions and the relevance of statistical results in single case studies concerning heterogeneous networks. The emerging theoretical framework appears of general interest in view of the recently observed abundance of natural networks with complex topological features and might provide useful insights for the development of adaptive strategies aimed at epidemic containment.

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