1135-91-2773 **Daniel B Larremore*** (daniel.larremore@colorado.edu), **Caterina De Bacco** and **Cristopher Moore**. *A physical model for efficient ranking in networks.*

We present a principled model and algorithm to infer a hierarchical ranking of nodes in directed networks, which we call SpringRank. Unlike other methods such as minimum violation ranking, it assigns real-valued scores to nodes rather than simply ordinal ranks, and it formalizes the assumption that interactions are more likely to occur between individuals with similar ranks. It provides a natural framework for a statistical significance test for distinguishing when the inferred hierarchy is due to the network topology or is instead due to random chance, and it can be used to perform inference tasks such as predicting the existence or direction of edges. The ranking is inferred by solving a linear system of equations, which is sparse if the network is; thus the resulting algorithm is extremely efficient and scalable. We illustrate these findings by analyzing real and synthetic data and show that our method outperforms others, in both speed and accuracy, in recovering the underlying ranks and predicting edge directions. (Received September 26, 2017)