Disagreement percolation for Gibbs point processes

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A Gibbs point process in the low activity (also called high-temperature) regime is expected to behave close to the ideal gas, here the Poisson point process. In particular, one expects just a single Gibbs state, i.e., absence of phase transition, analyticity of the free energy and strong decay of the correlation functions. Disagreement percolation is a technique to control the differing boundary conditions in a Gibbs specification by a simpler Boolean percolation model. In the low activity regime, the percolation model does not percolate and implies the uniqueness of the Gibbs PP. If the percolation has exponentially decaying connection probabilities, then exponential decay of correlations and analyticity of the free energy holds, too. This technique has first been extended from the discrete case to bounded range simple Gibbs point processes. An extension to particle processes yields a functional CLT for U-statistics of functionals with finite support. A relaxation of the finite interaction range yields a first proof of uniqueness of the Gibbs state for the continuum random cluster model at low activities. A core building block is a dependent thinning from a Poisson point process to a dominated Gibbs point process within a finite volume, where the thinning probability is related to the derivative of the free energy of the Gibbs point process.