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## Minimizing non local functionals on measures. Relaxation and asymptotics.

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Optimization problems on probability measures in  $\mathbb{R}^d$  are considered where the cost functional involves multimarginal optimal transport. In a model of N interacting particles, the interaction cost is repulsive and described by a two-point function  $c(x,y)=\ell(|x-y|)$  where  $\ell:\mathbb{R}_+\to [0,\infty]$  is decreasing to zero at infinity. Due to a possible loss of mass at infinity, non existence may occur and relaxing the initial problem over subprobabilities becomes necessary. In this talk we will describe the relaxed functional to be minimized as well as its  $\Gamma$ -limit as  $N\to\infty$ . Then we study the limit optimization problem when a continuous external potential is applied. Conditions are given with explicit examples under which minimizers are probabilities or have a mass <1. In a last part we consider the case of a infinitesimal range interaction  $\cot \ell_N(r)=\ell(r/e)$  ( $e\ll 1$ ) with the aim of determining the mean-field limit energy as  $e\to 0$  of a very large number  $N_e$  of particles confined in a given compact subset of  $\mathbb{R}^d$ .

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