# HYDRODYNAMIC LIMIT FOR ULTRA-FAST DIFFUSION EQUATION

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**Resumo/Abstract:**
The fast diffusion equations are a collection of PDEs of the form $\partial_t \rho = \Delta \rho^m$, in the different ranges of exponents $m < 1$ and dimension $n$. From the PDE point of view the theory is quite complete in the super-critical case $m_c < m < 1$, where $m_c = (n-2)/n$, while problems remain open in the range $m < m_c$.

We obtain the critical fast diffusion equation in dimension 1 with $m = -1$, also called super-diffusion or ultra-fast diffusion, as hydrodynamic limit of a zero-range process with *symmetric unit rate g*.

The fast diffusion effect comes from the fact that the diffusion coeficient $D(\rho)$ goes to infinity as $\rho \to 0$, here $\rho$ denotes the density of particles in systems. In order to capture this explosion we consider a model with a typically high number of particles per site. We follow the Relative Entropy method to prove the hydrodynamic limit.