The Porous Medium Equation: Rescaled Zero-Range Process, Large Deviations and Gradient Flow

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We study a rescaling of the zero-range process with homogenous jump rates $g(k)=k^\alpha$ with arbitrary $\alpha\ge 1$. With a simultaneous rescaling of space, time and particle size, we identify the dynamical large deviations from the porous medium equation, using pathwise discretised regularity estimates to prove a version of the superexponential estimate in the spirit of the Aubin-Lions-Simons lemma. Finally, we use the large deviation principle to give an expression of the porous medium equation as the gradient flow of the Boltzmann entropy with respect to a tailor-made Wasserstein-type distance.