Unbounded viscosity solutions of Hamilton-Jacobi equations with mechanical Hamiltonian in Wasserstein space

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In this talk, we discuss the value function arising in classical mechanics in the space of probability measures over the Euclidean space, endowed with the 2-Wasserstein distance. Similar to the classical setting, we aim to show that the value function is the unique solution to a suitable Hamilton-Jacobi equation. This problem can be seen as the limiting case of a "perturbed" problem by the Wasserstein gradient of the relative entropy function. Well-posedness of the Hamilton-Jacobi equation associated with the perturbed problem is well established in the literature under suitable assumptions. In contrast, proving well-posedness for the corresponding limiting problem using the same techniques turned out to be significantly more challenging and remains until now an open question. The main contribution of this work is to demonstrate that the limiting case can be treated within essentially the same viscosity-solution framework as the perturbed case.

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