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Congested transport problems and equilibria

The talk will be a survey about the continuous models that we introduced years ago with Carlier and Jimenez to provide a continuous formulation of the so-called Wardrop equilibrium problem. This problem, in its original formulation, is concerned with the traffic intensity on a given network, where every agent must choose his own trajectory so as to minimize his cost, but this cost depends on the traffic intensity he meets on his road, i.e. on the choices of all the other agents. This equilibrium problem is of variational origin, as the equilibrium can be obtained by minimizing a global congestion cost. The continuous model provides a description of the same phenomenon, but replacing the finite network with a domain in R^n where all trajectories are admissible. The traffic intensity turns out to be ruled in some cases by an elliptic PDE, which is very degenerate in all situations which are relevant in modeling, and obtained by a convex minimization problem for which efficient algorithms exist. In the talk, I will give an introduction to these questions, and present some of the most recent results and open questions (based on joint works with Carlier, Jimenez, Brasco, Benmansour, Peyré, and Vespri, and on the contributions by many other people).