

Uniqueness in a class of Hamilton-Jacobi equations with constraint

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We discuss a class of Hamilton-Jacobi equations with constraint, where an unknown function of time is intended to keep the maximum of the solution to the constant value 0. Our main result is that the full problem has a unique viscosity solution, which is in fact classical. The motivation comes from evolutionary biology and a selection-mutation model which, in the limit of small mutations, exhibits concentration on a single point, corresponding to a dominant trait which evolves in time. This evolving dominant trait is indeed determined as the zero level set of the solution of the Hamilton-Jacobi equation. This result provides also a constructive existence result and implies strong convergence and asymptotic expansion for the selection-mutation model, leading to more quantitative results for the biological applications. This is a joint work with Jean-Michel Roquejoffre.