Abstract: In the Mean Field Games (MFG) framework where there is an agent (so-called Major) which has asymptotically non-vanishing influence on any other agent (so-called Minor) the mean field becomes stochastic due to the stochastic evolution of the state of the Major agent. Consequently, the best response control actions of the Minor agents depend on the state of the Major agent as well as on the stochastic mean field; this in contrast to the basic MFG setup where the mean field is deterministic and the actions of the Minor agents depend on the deterministic mean field. The theory of MFG with a Major agent (MM-MFG) is well understood when the observations of the Minor agents are complete.

In this work we analyze the MFG problem with a Major agent when the Major agent's state is partially observed by the minor agents. We first develop Nonlinear Filtering Theory for partially observed stochastic dynamical systems described by McKean-Vlasov (MV) stochastic state equations. Applying the standard separation methodology, we analyze the associated completely observed system obtained via application of the nonlinear filtering theory derived above. The existence and uniqueness of the solutions of the stochastic MFG system as well as the epsilon-Nash equilibria property of such a solution are established in this setting.

This is joint work with Peter E. Caines.