Jamitons and the Predictive Accuracy of Macroscopic Traffic Models

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Phenomenologically, the macroscopic (i.e., fluid-dynamical) description of vehicular traffic flow is further removed from reality than its microscopic (i.e., vehicle-based) description. It is therefore an important question (that we have been asked by many traffic engineers) why one should study macroscopic models. In this talk we demonstrate how the phenomenon of ``phantom traffic jams'' (the occurrence of traffic waves without any discernable cause) can be understood using an anology between traffic waves (``jamitons'') and detonation waves. It turns out that the macroscopic description provides fundamental insights into the dynamics of jamitons that goes beyond what is known from the microscopic modeling of the same phenomenon. While the dynamics of traffic waves can be understood via macroscopic second-order models, the predictive accuracy of these models on actual traffic data has not been addressed. We present a study on various data-fitted second-order traffic models and provide some ideas on which macroscopic models can reproduce the dynamics of real traffic best.