**TEMPLE UNIVERSITY**
Department of Mathematics

# Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 24 October 2018, 4:00 p.m.

## Instabilities in Multiscale Traffic Flow

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**Abstract.** Traffic flow is known to be unstable when the vehicle density becomes too high, and to create stop-and-go waves, with an alternance of free flow and congested traffic. These instabilities can be reproduced by some traffic models, both microscopic (car-following models) and macroscopic (systems of conservation laws), and correspond to the multi-valued part in fundamental diagrams.

The search for self-similar solutions of macroscopic models in the unstable regime gives a two-parameter family of solutions called jamitons. However, numerical simulations show that most of these jamitons are unstable and will either split or merge; on an infinitely long road, only the jamiton with the lowest flow is stable for a given average density.

For real-time applications, the scale of these perturbations make them difficult to accurately predict. Using averaging technique can lead to new macroscopic models where only the average flows are considered.

Finally, we show that autonomous cars with the right driving algorithm could stabilize the traffic, even at low penetration rates.