CPS: Breakthrough: Selective Listening: Control for Connected Autonomous Vehicles in Data-Rich Environments

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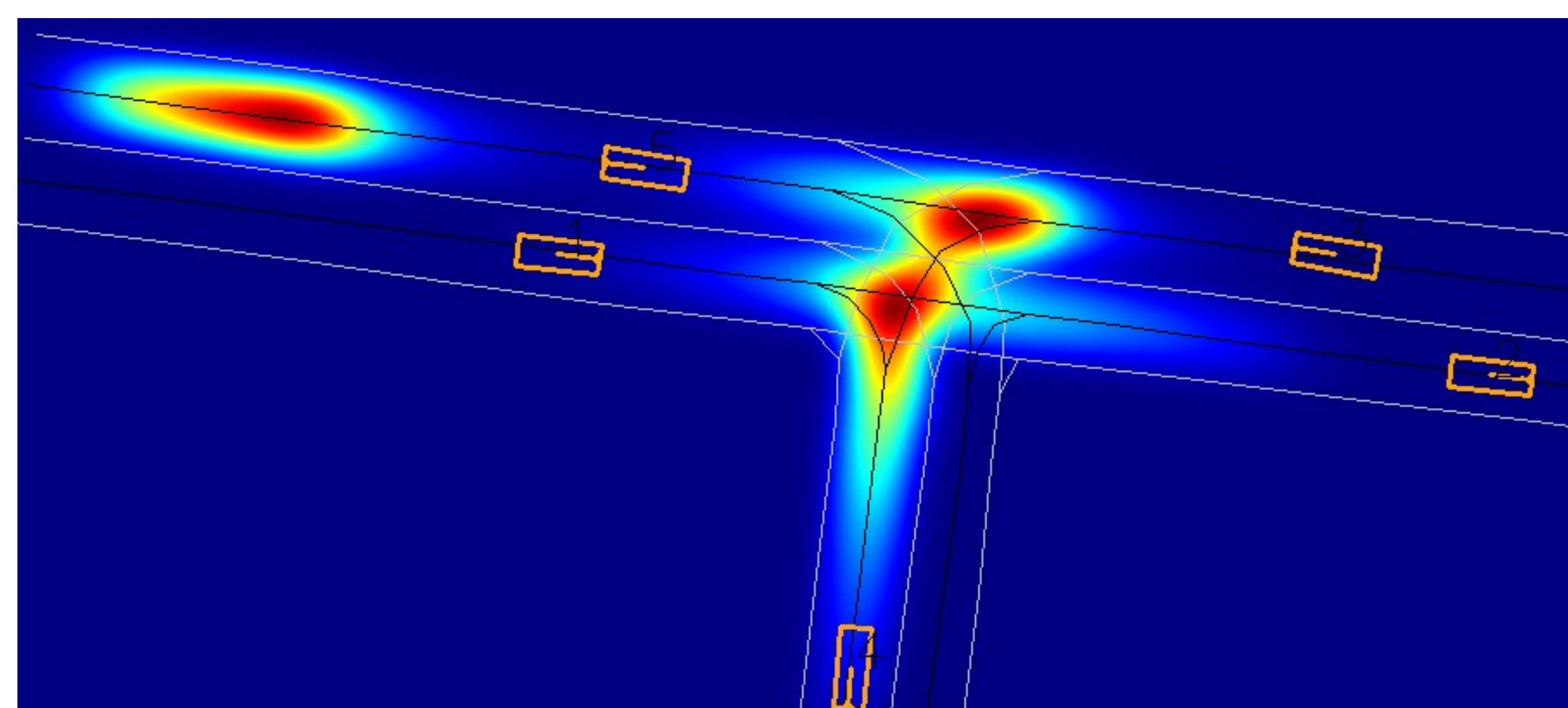Electrical & Computer Engineering

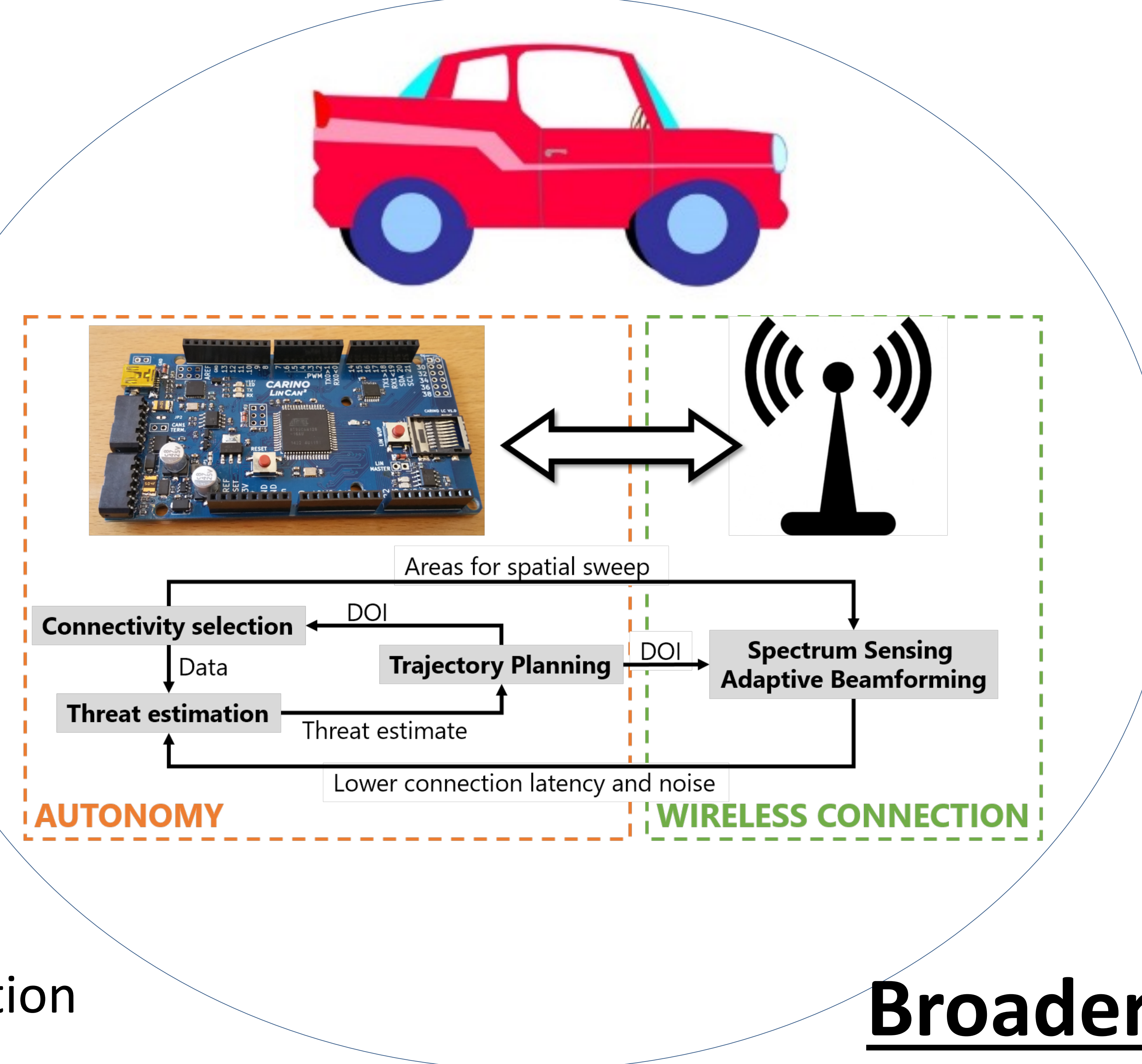*Worcester Polytechnic Institute*

Challenge:

- How do estimation and control algorithms in CAVs affect V2V communications?
- How do we use spectrum-scarce V2V comms. improve estimation and control?

Solution:

- Adaptive beamforming for vehicle-to-vehicle communications
  - Analysis of the effects of localization errors and interference sources on V2V comms. performance
  - Techniques to mitigate degradation in comms.
- Coupled trajectory planning and V2V link selection
  - Integration of data acquired from V2V comms. with onboard sensor data
  - Technique for selecting the most informative V2V links in congested traffic
  - Iterative short-term trajectory planning and V2V link selection to reduce trajectory uncertainty

Spatiotemporal threat field to be estimated using onboard sensors and V2V links
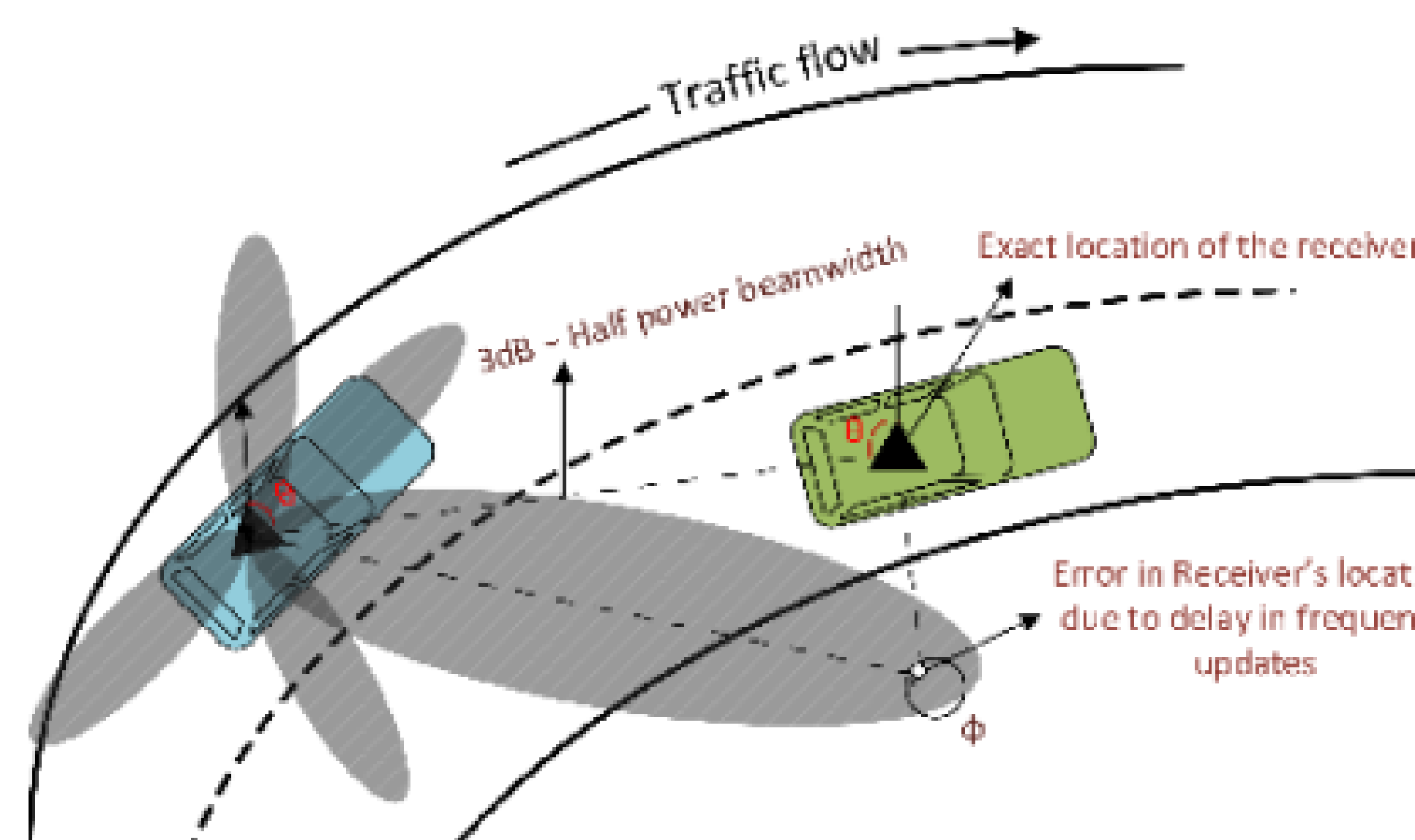

Adaptive beamforming for directional V2V links

Scientific Impact:

- Control and communication go hand-in-hand in many CPS applications
- Our work studies the bidirectional impact of control and comms.
- Realistic modeling of comms. as a "prefilter" to control and estimation algorithms
- Future: graceful degradation in comms. and control in off-nominal situations

Broader Impact:

- V2V comms. can vastly improve traffic safety; these project outcomes provide ways to use V2V comms. in self-driving cars:
  - The basis for reliable, low-latency V2V comms.
  - The methods to judiciously select and use V2V data along with onboard sensor data in self-driving cars
- Outreach: PI and co-PI organized three summer symposia (2016 – 18) dedicated to CAV education
  - Also organized mini-workshop on CAVs at 2019 PI Meeting