CAREER: Temporal Causal Reinforcement Learning and Control for Autonomous and Swarm Cyber-Physical Systems

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Challenge: Application of AI to CPS:

- Lack of causal reasoning in AI-based decision-making
- Overreliance on large datasets and environment interactions
- Limited scalability for complex tasks and environments

Solution:

- Discovering temporal causal knowledge for improving sampling efficiency and transferability of RL
- Temporal causal reasoning for multi-agent RL in stochastic game environments
- Temporal causal reasoning for RL of large-scale swarm systems

Scientific Impact:

- This project will bridge the gap between causal inference and RL by developing novel causal RL approaches that will significantly improve the sampling efficiency, transferability, and scalability of RL. Such RL agents can be deployed in real-world CPS operations such as search and rescue, security patrol, and manufacturing.

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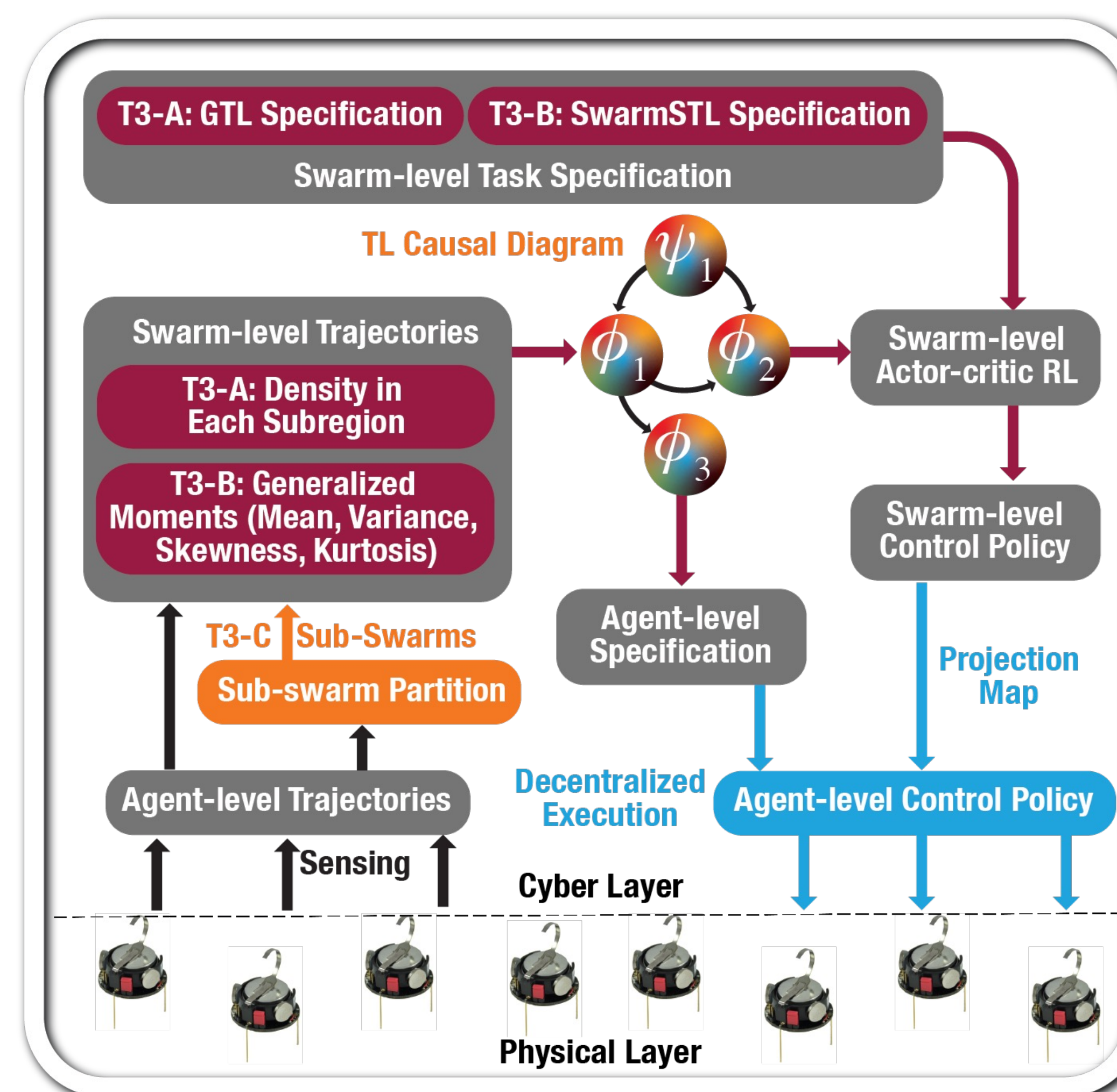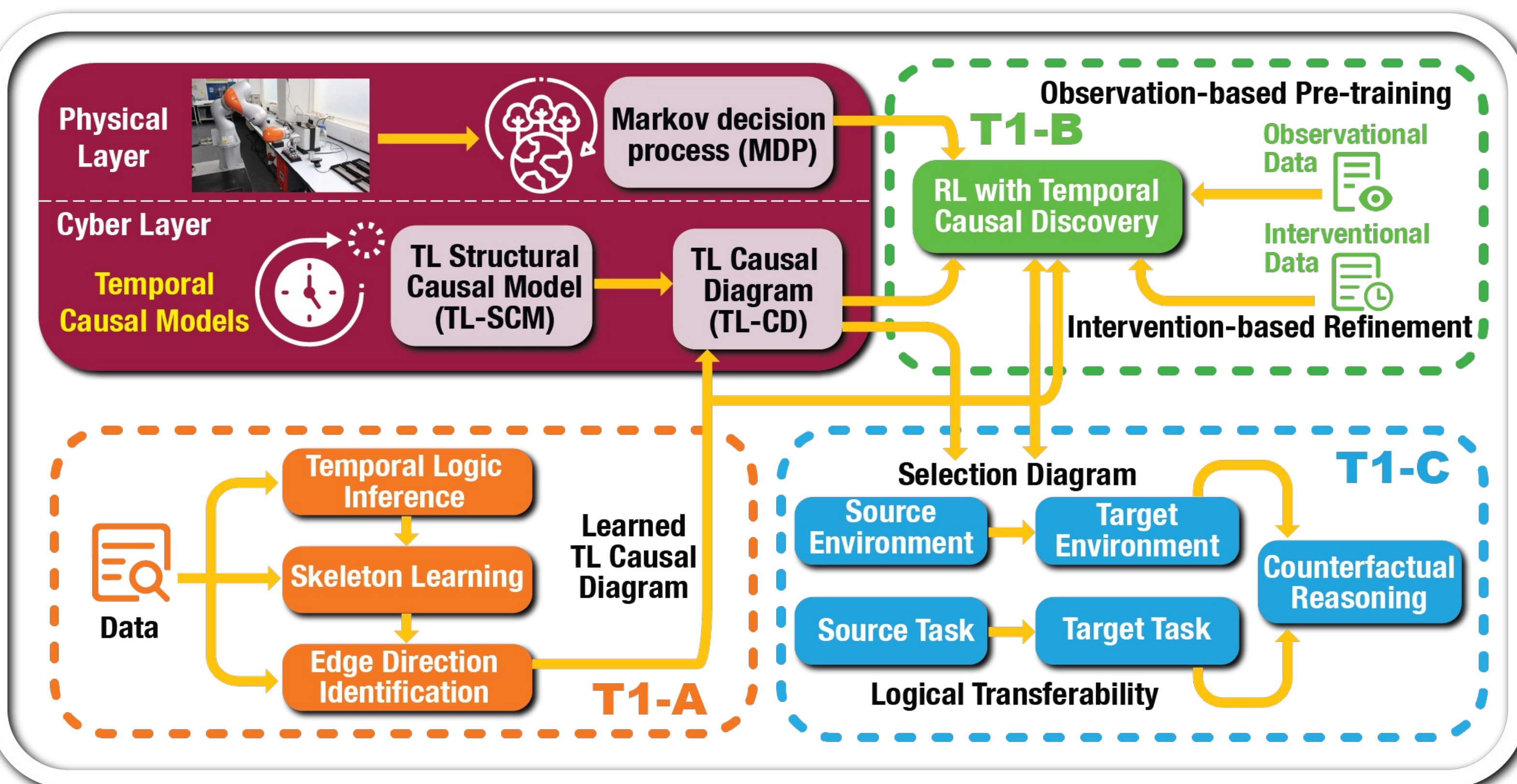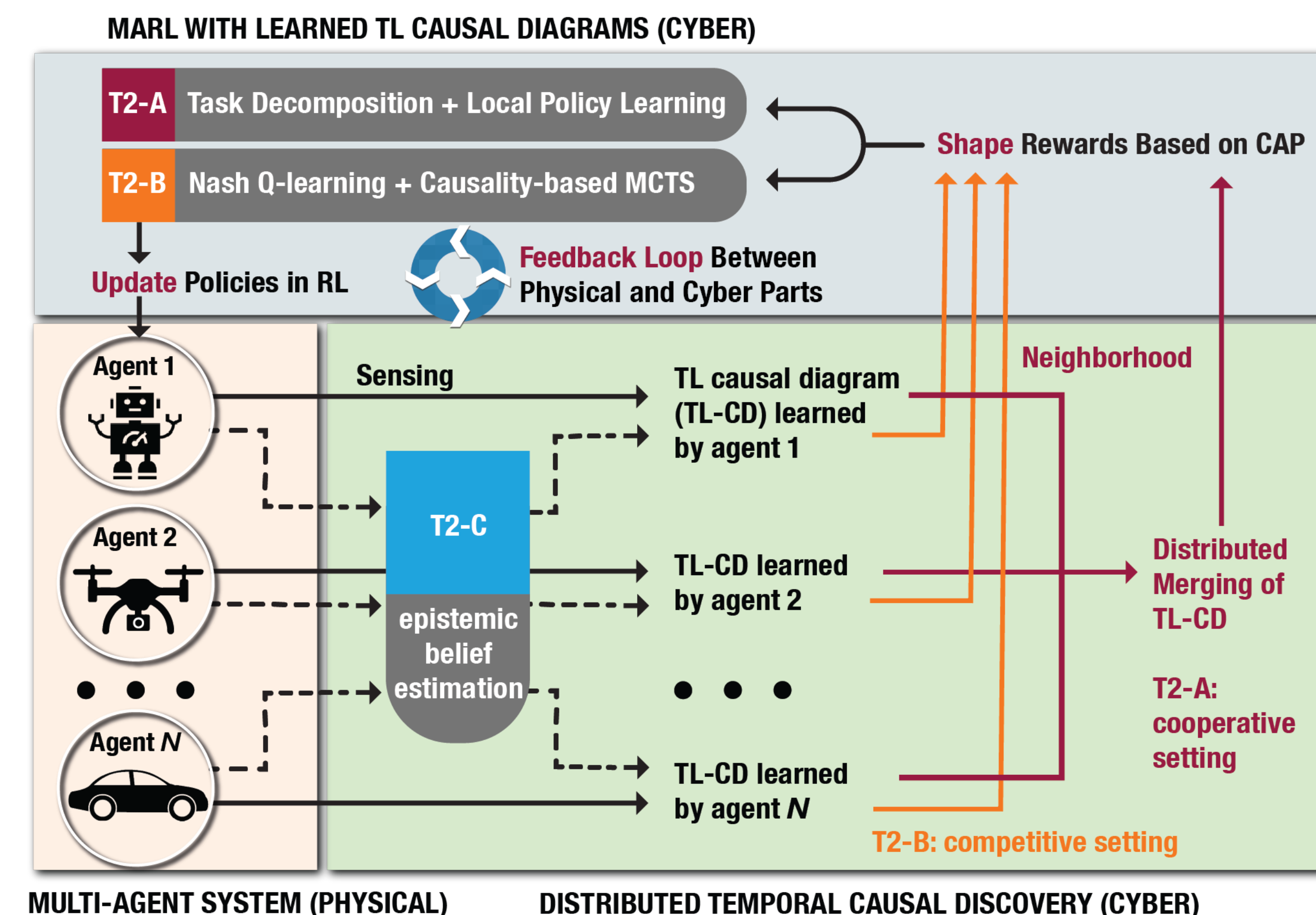
Broader Impact:

- AI-assisted adaptive and interactive learning and teaching
- Integrating AI-based CPS in undergraduate and graduate courses and research workshops
- K-12 outreach to local high schools in the Phoenix and Tempe Union High School Districts