Abstract Submitted
for the TSF21 Meeting of
The American Physical Society

A mean-field approximation of viral transmission BAYLOR FAIN, HANA DOBROVOLNY, Texas Christian University — As a virus spreads in a host, the virus moves in a spatially-extended, heterogeneous environment. Previous research has mostly used ordinary differential equations to model the dynamics of viruses. The ordinary differential equations are only dependent on time, which limits the incorporation of the spatial aspect of viral spread. Despite this, the ordinary differential equations have had success in modeling viruses that transmit mostly via cell-free transmission but have not been able to fully reproduce dynamics of viruses that spread via cell-to-cell transmission. Without the dependence of space, certain modes of viral transmission cannot be properly modeled. This work uses a mean-field approximation to incorporate the spatial dependence of neighboring cells, allowing for the effects of cell-to-cell transmission to be modeled. With the model, three different scenarios of viral transmission are compared: (1) cell-free transmission only, (2) cell-to-cell transmission only, and (3) both cell-free and cell-to-cell transmission together. For each of the three scenarios, the probability that the viral infection will spread to infect every cell is calculated.

Baylor Fain
Texas Christian University

Date submitted: 14 Sep 2021 Electronic form version 1.4