Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The Flow Physics of Social Distancers: Uncovering Patterns in Pandemic-Era Pedestrian Flows using Particle-Based Simulations KELBY KRAMER, GERALD WANG, Carnegie Mellon University — In the era of COVID-19, the practice of social distancing has become a widespread and essential strategy for mitigating disease transmission. As people gradually return to shared indoor spaces in Fall and Winter 2020, the desire to maintain social distance will create new challenges for pedestrian flows in confined environments (e.g. corridors), even when buildings are kept at relatively low density. In this work, we report the results of 2D particle-based simulations modeling confined pedestrian counter-flows, with individual pedestrians described as active particles trying to maintain a target velocity while avoiding collisions. By systematically varying two quantities – the pedestrian volume fraction ϕ and the "social distance" d, a characteristic lengthscale reflecting mutual agreements about desirable inter-pedestrian spacing – we compute fundamental diagrams for confined and socially distanced pedestrian flows, which show average pedestrian velocity $\bar{v}$ as a function of ϕ and d. These results illustrate the sensitive dependence of $\bar{v}$ on d, including a jamming transition, even at modest values of ϕ. These results underscore the need for careful planning as large, shared indoor spaces return to any appreciable levels of occupation.

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Date submitted: 02 Aug 2020 Electronic form version 1.4