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*Dynamics of the asymptomatic infection in the spread of SARS-CoV-2*

The COVID-19 pandemic continues with multiple waves of outbreaks, Omicron changed the game one year ago and still dominates. Among many of the factors including emerging VOCs, vaccine and reinfection, nonpharmaceutical interventions, behavior and adherence of individuals, asymptomatic infection plays a special role responsible for the repeated outbreaks and therefore exit strategy. In this talk, I will present models emphasizing the role of asymptomatic infections. For a more general form of the incidence function for the asymptomatic cases, the complex dynamics are found to be associated with the Bogdanov-Takens bifurcation of codimension 2, I will explain the threshold conditions for the transient and asymptotic dynamics of the transmission. The existence of a nilpotent singularity and unstable Bogdanov-Takens bifurcations partially explains the reason and mechanisms of the repeated multiple-waves epidemics. The models were validated using data from a recent omicron wave in areas where partial test or citywide test-trace-isolate Zero-COVID policy were implemented.