

The Virginia Tech Physics Department presents the following colloquium:

Dr. Leah Shaw (Naval Research Laboratory)

“Desynchronization and Spatial Effects in Multistrain Diseases”

Abstract:

Dengue fever, a multistrain disease, has four distinct co-existing serotypes (strains). The serotypes interact by antibody-dependent enhancement (ADE), in which infection with a single serotype is asymptomatic, but contact with a second serotype leads to serious illness accompanied by greater infectivity. It has been observed from serotype data that outbreaks of the four serotypes occur asynchronously (Nisalak et al., Am. J. Trop. Med. Hyg. 68: 192). We present a compartmental model for multiple serotypes with ADE, and consider autonomous, seasonally driven, and stochastic versions of the model. For sufficiently small ADE, we find that the number of infectives of each serotype synchronizes, with outbreaks occurring in phase. However, when the ADE increases past a threshold, the system becomes chaotic, and infectives of each serotype desynchronize. Certain primary and secondary infective compartments remain synchronized in the chaotic regime, a result which is explained by our analysis and which may be useful for disease monitoring. Spatial effects are included via coupled patch models and reaction diffusion equations. We observe desynchronization between spatially distinct regions.

Friday, January 19, 2007
210 Robeson Hall
2:30 P.M.