Co-evolution of virus and games

Mayte Pérez-Llanos, U. de Sevilla

Mathematical modeling of virus dynamics is key to depicting the evolutionary pathways that lead to virus emergence, transmission, and persistence. Typically, viruses are populations of closely related genomes that continuously change their configuration and adapt to environmental selection pressures. In this talk, we revisit this idea by considering viruses as active particles that dynamically shape their ecological niche. To this end, we adapt the Kinetic Theory of Active Particles to model virus interactions, allowing payoffs to co-evolve as a function of the population's configuration. We deduce the system of ordinary equations corresponding to the replicator dynamics with frequency-dependent payoffs. Then we obtain a nonlinear integro-differential equation describing the dynamics for a continuum of strategies by passing to the limit in the replicator system when the number of equations grows. Finally, we present some examples of virus dynamics.

This talk is based on the results of the following preprints:

- *Co-evolution of virus and games*, by Román D. González-Mora, Pablo Aguilera, MPL, María Inés Gismondi, Juan Pablo Pinasco.
- *Replicator dynamics for continuous strategies: bridging agent-based models and integro-differential equations via numerical analysis* By Natalia Kontorovsky , MPL and Juan Pablo Pinasco.