THE CRM APPLIED MATHEMATICAL PHYSICS (CAMP) SEMINARS

CENTRE DE RECERCA MATEMÀTICA

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Modelling epidemics dynamics with time dependent infectivity parameters. The example of Dengue in Rio de Janeiro.

Migratory fluxes of humans and of insects of various species have favoured the spreading of diseases world-wise. In particular the Ae. Agypti and Ae. Albopcitus mosquitoes of the Aedes family, are vectors able to transmit and spread among humans a variety of diseases : Dengue, Zika, Chikungunya, Yellow fever and, the newly discovered, Mayaro (Hotez et al. PLoS Negl. Trop Dis. 2017). The Ae. Albopictcus, able to survive even at low temperature, is already well established in Europe, while the Ae. Aegypti, traditionally present in tropical regions are now starting colonizing part of Europe. The overlapping of the two mosquitoes is worrisome since it could increase the spreading of the concerned diseases. In France recent cases of locally transmitted Chikungunya have been reported (22 August,2017,http://outbreaknewstoday.com/france-reports-two-locally-transmitted-chikungunya-cases-south-45270/) in addition to locally transmitted cases of Dengue virus type 1 (DENV-1) already registered in Nimes, south of France, in 2015 (https://www.e-sciencecentral.org/upload/eurosurv/pdf/eurosurv-21-21-22485.pdf) Dengue is rather invasive epidemic due to the fact that already four different serotypes are present. It is important to stress that those epidemics can have strong social and economical impacts if not seriously controlled. Only in 2010 in Brazil, one million infected individual of which 80,000 where hospitalized.

I shall revisite the SIR model with birth and death terms and time-varying infectivity parameter β(t) and introduce a network extension of it, SIR.Network. For a quite general slowly varying β(t) (not necessarily periodic) infectivity parameter we prove the existence of an attractor and we are able to determine an approximation : all the trajectories of the system are proven to be attracted into a tubular region around a suitable curve, which is an approximation of the underlying attractor. Numerical simulations are given and data fitting with real data from Dengue epidemics in Rio de Janeiro and So Paulo allow us to estimate the infectivity rate and make predictions about what are the periods more at risk of infection. A possible epidemic attractor is visualized and approximated. Finally I shall talk about work in progress with data from all over Brasil.

Date:	**February 13th, 2019**
Place:	**Room C1/028**
Time:	**12:00**