



# Meiji University Global COE Program 39<sup>th</sup> Mathematical Sciences based on



## Modeling, Analysis and Simulation seminar

Date: May 12, 2011, 16:30~18:00

Location: Meiji Univ. Ikuta Campus, Build 2 Annex A, Room A207

**Ryusuke Kon** (Meiji University)

Title : Permanence induced by life-cycle resonances:  
the periodical cicada problem

Abstract: Periodical cicadas (*Magicicada* spp.) are insects inhabiting the Eastern United States. They are known for their unusually long life cycle for insects and their prime periodicity of either 13 or 17 years (i.e., their life span is either 13 or 17 years and they emerge periodically from the ground exactly every 13th or 17th year). One of the explanations for the prime periodicity is that the prime periods are selected to prevent cicadas from resonating with hypothetical predators with submultiple periods. In this talk, we consider this hypothesis by investigating a mathematical model for dynamically interacting periodical predator and prey. This study shows that if the periods of the two periodical species are not coprime, then the predator cannot resist the invasion of the prey since the invasion of the prey is always facilitated by its well-timed cohorts. On the other hand, if the periods are coprime, then the predator can resist the invasion of the prey. It is also shown that if the periods are not coprime, then the life-cycle resonance induces a permanent system, in which no cohorts are missing in both populations. This contrasts with the result that systems consisting of coprime periodical species cannot be permanent. These results suggest that prime periodicities are not advantageous even under hypothetical periodic predation pressure.

Everyone is welcome to attend the MAS seminar.

Meiji institute for Advanced Study of Mathematical Science (<http://www.mims.meiji.ac.jp>)

(Organizers: M. Mimura, D. Ueyama, Y. Wakano, K. Ikeda and S.Kinoshita)

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Access: 10 minutes on foot from Ikuta St. Odakyu line,  
Or 10 minutes by bus No. 13「明治大学正門前」, get off at the last stop.  
See [http://www.meiji.ac.jp/koho/campus\\_guide/](http://www.meiji.ac.jp/koho/campus_guide/) for details.