Boston University Physics Colloquium
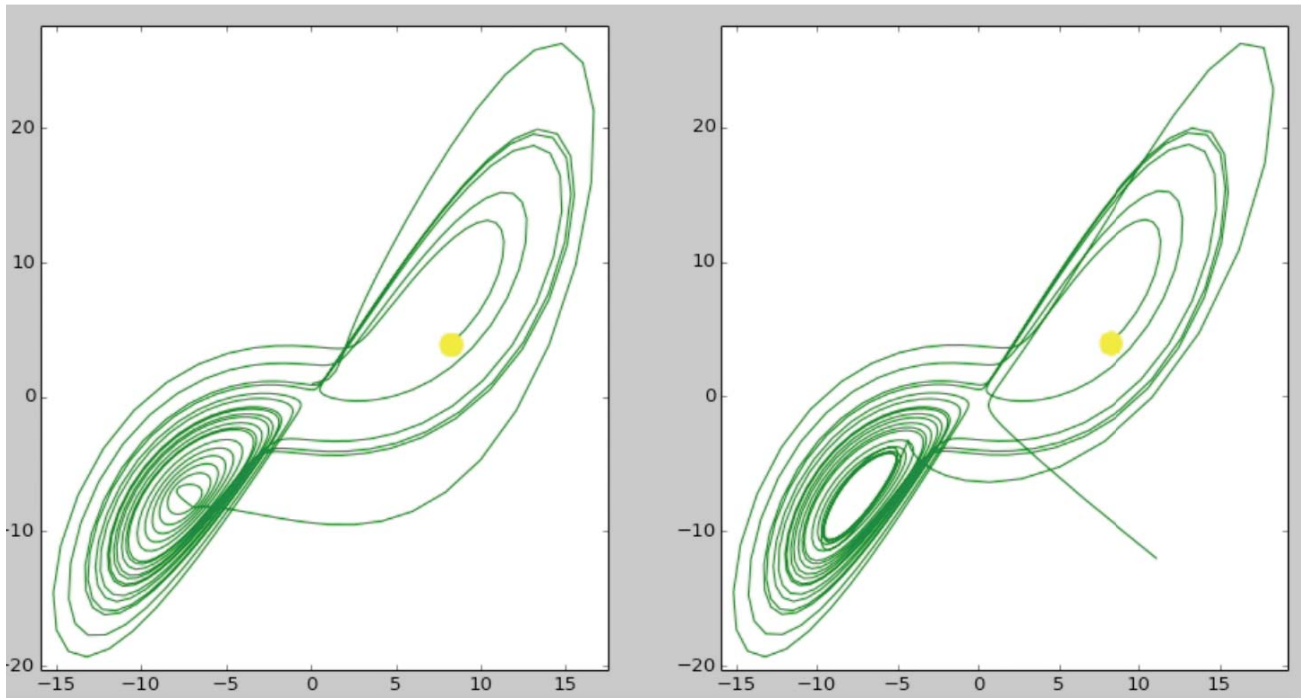
How to Synchronize Chaotic Systems

Louis Pecora
United States Naval Research Laboratory

October 17, 2017
Tuesday

3:30 - 4:45 PM
Refreshments at 3:00 in SCI Lounge

SCI 109
590 Commonwealth Ave

The concept of synchronized systems has been around for centuries with one of the earliest studies being on the synchronization of clocks by Christiaan Huygens in the mid 1700's. By the mid 1900's it was well-known how to mathematically model the synchronization of systems that oscillated periodically or regularly, i.e. in a steady, repeatable way. But as a new type of motion called chaos started to be studied in the 1970's the notion of synchronization of such systems was difficult to grasp since chaotic systems never repeated or had regular periodic motion. Their movement was complex on all levels and fractal in nature. I'll introduce the notion of chaos and then show how one can synchronize chaotic systems. I'll give a little history of the subject and mention some possible uses proposed for such systems. Although I will start with two synchronized chaotic systems, I'll show how to synchronize an entire network of chaotic oscillators and, more importantly, how to determine the stability of such systems in a way that solves the problem phor all networks linking a particular oscillator type at each network node. I'll wind up introducing the more complex problem of cluster synchronization, which I'll talk about at a more technical talk the following day.