



ECE - Distinguished Lecturer Series
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Microwave Chaotic Oscillator – a Device Based on the Three-Wave And Four-Wave Interactions of Spin Waves in Magnetic Films

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Host: Nian Sun

Abstract:

Chaotic microwaves are useful for microwave chaotic communications. This talk will present recent progress in the development of a new type of microwave chaotic oscillators. These devices consist of a magnetic yttrium iron garnet (YIG) film strip-based active feedback ring system. The generation of chaotic microwaves is realized through the excitation of chaotic spin waves in YIG films by means of three-wave and four-wave nonlinear interactions. In the three-wave case, the experiments were done with backward volume spin waves in a low-field regime where the three-wave interactions were dominant nonlinear processes. In the four-wave case, the experiments were carried out with surface spin waves in a high-field regime where the three-wave interactions were prohibited and the chaotic excitation was realized through the four-wave interactions. The chaotic nature of the signals was confirmed by the broad power-frequency spectra and the saturation of correlation dimensions. It was found that the fractal dimensions of the chaotic signals could be controlled by changing the ring gain coefficient. The talk will begin with an introduction to spin waves in magnetic films and general concepts about chaos. In the end of the talk, a microwave chaos-based security communication scheme will be discussed briefly.

Bio:

Dr. Mingzhong Wu received his Ph.D. degree in Electronic Science and Technology from Huazhong University of Science and Technology in 1999. Currently, he is an Assistant Professor in the Department of Physics at Colorado State University (CSU). He is also an affiliate professor in the North University of China and a Senior Member of the Institute of Electrical and Electronic Engineers (IEEE). He has authored and co-authored 67 papers in archive technical journals. At CSU, Dr. Wu's research group is interested in many topics in magnetism and magnetic materials. The current research areas include nonlinear spin waves, envelope solitons, chaotic dynamics, magnetization dynamics, ferromagnetic resonance, magnetic nano films, and microwave and millimeter wave magnetic materials and devices.