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Excitation of Chaotic Surface Spin Waves in Magnetic Film Feedback Rings through Three-Wave Processes AARON HAGERSROM, MINGZHONG WU, RICHARD EYKHOLT, Department of Physics, Colorado State University — Surface spin waves in magnetic thin films can undergo three-wave splitting and confluence processes. In a splitting process, a surface spin wave produces two volume spin waves at about half of its frequency. In a confluence process, two half-frequency volume waves interact to produce a surface wave. This presentation reports the excitation of chaotic surface spin waves in magnetic thin film-based active feedback rings through these three-wave nonlinear interactions. Previous work has demonstrated such chaotic excitation in feedback rings. Neither the development of spectral modes nor the fractal dimensions of chaotic signals, however, have been reported. Experiments were performed with a 5 μm-thick yttrium iron garnet film and a static magnetic field of about 120 Oe. At some ring gain level, a single ring eigenmode was excited. As the gain was increased, one observed the excitation of additional modes, an increase in the frequency spacing between these modes, a period-doubling bifurcation, and the onset of chaos. One also observed a shift of the main mode to lower frequencies with increasing the gain. The correlation dimensions of the chaotic signals were found to be in the 2-4 range. It was also found that the correlation dimension increases with the ring gain.

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