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Observation of Black Spin Wave Soliton Pairs in Magnetic Thin Films ZIHUI WANG, MINGZHONG WU, MIKHAIL CHERKASSKII, BORIS KALINIKOS, DEPARTMENT OF PHYSICS, COLORADO STATE UNIVERSITY TEAM, ST. PETERSBURG ELECTROTECHNICAL UNIVERSITY TEAM — Black solitons exist in media with repulsive nonlinearity. They have several unique features, one of which is a phase jump of 180 degree at the soliton center. A straightforward method to excite a black soliton is to use a black pulse – a narrow dip on a continuous wave. This method has been used to excite black solitons for surface spin waves in magnetic thin films. Theoretically, however, a black pulse should not evolve into a single black soliton. Rather, it should develop into a pair of black solitons so that the net phase change is either 0 degree or 360 degree. This phase condition is needed because the initial signal has no phase difference across the black pulse region. This presentation reports for the first time the formation of a pair of black solitons from a black spin-wave pulse. Experiments were done with a yttrium iron garnet film strip in a surface spin wave configuration. A pair of black solitons with opposite 180 degree phase jumps were observed in certain pulse power and width ranges. Beyond those ranges, one also observed a single black soliton and multiple black solitons. No matter what the number of solitons was, however, the net phase change across the soliton region was always zero. The experimental results were confirmed by simulations.

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