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Magnetic field dependence of the spin wave excitations in $Sr_2FeSi_2O_7$ KAZUKI IIDA, JOOSEOP LEE, NAOYUKI KATAYAMA, SUNG-DAE JI, SEUNGHUN LEE, University of Virginia, DUC LE, Helmholtz Zentrum Berlin, SUNG CHANG, NIST Center for Neutron Research, TAEHWAN JANG, YOONHEE JEONG, SANGWOOK CHEONG, Pohang University of Science and Technology, UNIVERSITY OF VIRGINIA TEAM, HELMHOLTZ ZENTRUM BERLIN COLLABORATION, NIST CENTER FOR NEUTRON RESEARCH COLLABORATION, POHANG UNIVERSITY OF SCIENCE AND TECHNOLOGY COLLABORATION — Without field, the multiferroic $Sr_2FeSi_2O_2$ orders below 4.7 K into a simple square-lattice antiferromagnetic collinear structure. Application of a magnetic field at low temperatures induces four different magnetic phases with spontaneous electric polarization. We report inelastic neutron scattering measurements on a single crystal of $Sr_2FeSi_2O_7$ under magnetic fields to investigate how the magnetic fluctuations change with field. In zero field, no dispersion was observed in L-direction, indicating that $Sr_2FeSi_2O_7$ is a two dimensional magnet. The dispersion relation along (H 0 0.5) shows a Goldstone mode arising from the magnetic Bragg position at (1 0 0.5) with a periodicity of $2 \times 2\pi/a$, suggesting that the strongest magnetic interaction is between the nearest neighbor Fe^{2+} ions. Under the field, the magnetic fluctuations become more complex than the simple splitting of the doubly degenerate Goldstone mode into two gapped modes.

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