Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Observation of spin-density wave propagation in a spinor Bose-Einstein condensate JOON HYUN KIM, DEOKHWA HONG, YONG-IL SHIN, Seoul National University — We report the observation of spin-density wave propagation in a spin-1 antiferromagnetic spinor Bose-Einstein condensate. We develop a spin-dependent optical obstacle which is attractive for $m = 1$ and repulsive for $m = -1$ with equal potential heights, by using a laser beam with its frequency tuned between the D_1 and D_2 transitions. By suddenly turning off the obstacle beam penetrating a condensate in an easy-plane polar phase, we observe that a magnetization pulse wave is generated. The pulse wave consists of a density dip of the $m = -1$ component and a density bump for $m = 1$, and it propagates non-dispersively with a constant speed v_s, which demonstrates the linear dispersion of magnon mode of the spinor superfluid system. For comparison, we generate a mass-density wave in the same system, by using an ordinary spin-independent obstacle beam, and measure its propagation speed v_m. In our experiment, the ratio of v_s/v_m is measured to be 0.20, which asserts that c_2 is twice larger than the conventional value from [PRL 99, 070403 (2007)]. Finally, we investigate a situation where the condensate is perturbed with an imbalanced potential for the two spin components, and observe that both mass and spin excitations are generated simultaneously but propagate separately.

Joon Hyun Kim
Seoul National University

Date submitted: 01 Feb 2019 Electronic form version 1.4