Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

**Spin Wave Excitations in the Multiferroic $Ba_2CoGe_2O_7$** TOOMAS ROOM, National Institute of Chemical Physics and Biophysics, Tallinn, Estonia, KARLO PENC, JUDIT ROMHANYI, Institute for Solid State Physics and Optics, Hungarian Academy of Sciences, Budapest, URMAS NAGEL, National Institute of Chemical Physics and Biophysics, Tallinn, Estonia, AGNES ANTAL, TITUS FEHER, ANDRAS JANOSSY, Department of Physics, Budapest University of Technology, Hungary, HANS ENGELKAMP, High Field Magnet Laboratory, Institute for Molecules and Materials, Radboud University, Nijmegen, The Netherlands, H. MURAKAWA, YOSHI TOKURA, Quantum-Phase Electronics Center, Department of Applied Physics, The University of Tokyo, Japan, DAVID SZALLER, SANDOR BORDACS, ISTVAN KEZSMARKI, Department of Physics, Budapest University of Technology, Hungary — $Ba_2CoGe_2O_7$ is a multiferroic material where spin waves exhibit giant directional dichroism and natural optical activity at THz frequencies due to the large ac magnetoelectric effect [S. Bordacs et al., Nature Physics **8**, 734 (2012)]. We studied spin excitations in the magnetically ordered phase of the non-centrosymmetric $Ba_2CoGe_2O_7$ in high magnetic fields up to 33 T [Penc et al., Phys. Rev. Lett. **108**, 257203 (2012)]. In the ESR and THz absorption spectra we found several spin excitations beyond the two conventional magnon modes expected for such a two-sublattice antiferromagnet. A multiboson spin-wave theory describes these unconventional modes, including spin-stretching modes, characterized by an oscillating magnetic dipole and quadrupole moment. The lack of inversion symmetry allows each mode to become electric dipole active.

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Date submitted: 07 Nov 2012 Electronic form version 1.4