Optical coupling to spin waves in multiferroic materials\textsuperscript{1}

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The coexistence of ferroelectricity and magnetism in multiferroic materials leads to several interesting effects related to the interplay of light with complex electric and magnetic order. One notable example is bismuth ferrite (BiFeO$_3$), a room temperature multiferroic that exhibits a large ferroelectric moment coexisting with a spiral antiferromagnetic phase in the form of a cycloid. I will describe a theory of bulk BiFeO$_3$, which predicts the appearance of several magnon branches related to magnetic fluctuations at integer multiples of the cycloid wavevector. These magnons get admixed with optical phonons at zero wavevector, giving rise to two series of electromagnon resonances in the far infrared spectrum \cite{1}, which were recently observed using Raman spectroscopy \cite{2}. I will show that these results are helpful in designing low loss electronic devices based on spin-wave propagation \cite{3}.

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