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**Wavenumber dependent Gilbert damping in metallic ferromagnets**[1] YI LI, WILLIAM BAILEY, Department of Applied Physics and Applied Mathematics, Columbia University, BAILEY TEAM[2] — New terms to the dynamical equation of magnetization motion, associated with spin transport, have been reported over the past several years. Each newly identified term is thought to possess both a real and an imaginary effective field leading to fieldlike and damplike torques on magnetization. Here we show that three metallic ferromagnets possess an imaginary effective-field term which mirrors the well-known real effective-field term associated with exchange in spin waves. Using perpendicular standing spin wave resonance between 2-26 GHz, we evaluate the magnitude of the finite-wavenumber ($k$) dependent Gilbert damping of the uniform mode ($\alpha_u$) and the first spin wave mode ($\alpha_s$) in three typical ferromagnets, $Ni_{79}Fe_{21}$, Co, and $Co_{40}Fe_{40}B_{20}$. By taking the difference of $\alpha_s$ and $\alpha_u$ and excluding the eddy current damping $\alpha_E$ ($\Delta\alpha_k = \alpha_s - \alpha_u + \alpha_E$), we find the presence of a $k^2$ term, as $\Delta\alpha_k = \Delta\alpha_0 + A_k \cdot k^2$ in all three metals. We interpret the new term as the continuum analog of spin pumping, predicted recently, and show that its magnitude, $A_k$=0.07-0.1 nm$^2$, is consistent with transverse spin relaxation lengths (1-3 nm) as measured by conventional spin pumping.

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