1023-44-1239 **Sarah K Patch*** (patchs@uwm.edu), PO Box 413, Dept of Physics, Milwaukee, WI 53201.
Ultrasound Absorption vs. Causality & Hyperbolicity.

Attenuation typically comes hand-in hand with dispersion. Causality imposes consistency conditions upon attenuation and dispersion, first derived for particles by Kramers and Kronig. We study ultrasound attenuation according to a power law, $e^{(-\alpha|\tau|^b L)}$ where $\alpha \in \mathbf{R}$, L is distance traveled, and τ is dual to t. We show that the dispersion relations derived by Waters, *et al* satisfy primitive causality, permitting arbitrarily fast propagation speed, as the standard heat kernel permits heat energy to propagate faster than the speed of light.

Dispersion is predicted to be very small for $b = 1$. Assuming constant soundspeed when $b = 1$ we derive an integral-differential equation. When $b = 2$, Titschmarsh's theorem implies zero dispersion and the governing equation is a PDE that can be directly related to the standard heat equation. Furthermore, the impulse response function is essentially the standard heat kernel, instantaneously smoothing solutions. This theory allows signals to propagate faster than the speed of light and is inconsistent with relativistic causality and therefore begs for development of a hyperbolic attenuation/propagation model. (Received September 25, 2006)