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Sonoluminescence and other energy focusing phenomena

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Fluids and solids that are driven off equilibrium do not return smoothly to the equilibrium state. Instead they can display a wide range of energy focusing phenomena. In sonoluminescence a sound wave passing through a fluid has its energy concentrated by 12 orders of magnitude to create ultraviolet picosecond flashes of light. For 30KHz sound waves the spectrum is a blackbody yet its size is so small as to confound theory. At the very low frequencies achieved with a water hammer the strength of a single flash can be up-scaled by 6 orders of magnitude so as to be visible to this audience, in a real time demonstration. In a ferroelectric crystal such as Lithium Tantalate the application of heat leads to the expulsion of electrons with energies that can exceed 100KeV. Upon striking a target x-rays are emitted. A crucial question relates to whether there exist experimental configurations in which these processes can be used to generate nuclear fusion. Energy focusing also plays a role in turbulence, where intermittency leads to the formation of unexpected structures. Static electricity generated by friction is another striking example of an energy focusing effect. In the 'barometer light' dragging glass through mercury at a speed of 1mm/sec leads to picosecond electrical discharges where the electrons are accelerated to over 1% the speed of light. Experiments indicate that this effect is related to phenomena encompassed by everyday friction.