

Why sound waves travel so far unimpeded in glasses at low temperatures

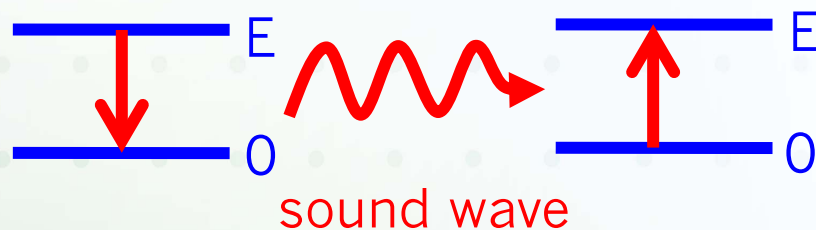
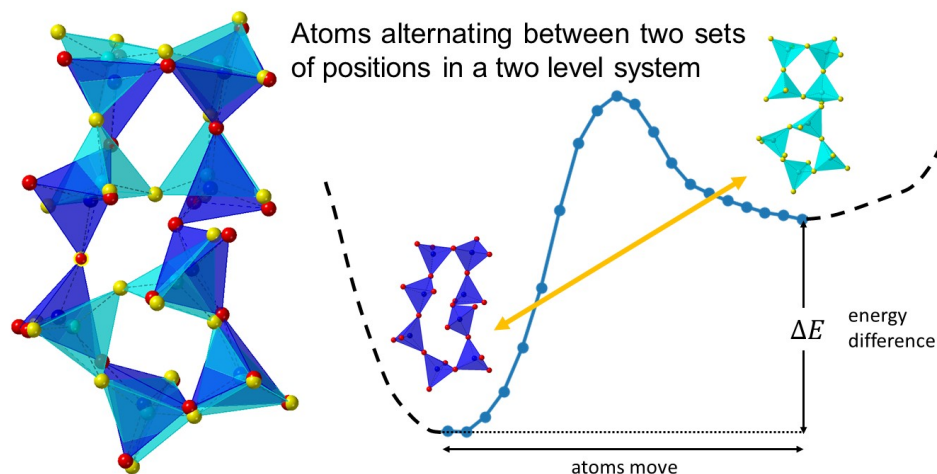
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Glasses are a random jumble of atoms. In some places inside a glass, an atom or group of atoms can alternate between two configurations, even at temperatures near absolute zero when everything should be frozen. These defects are called “two level systems” because the two configurations are associated with two different energies. Two level systems interfere with sound waves in glass, but not as much as physics says they should. Sound vibrations can travel amazingly far without hitting these defects.

IRG 1 shown how the atoms around the defects can restrict their ability to jump between configurations and how defects can talk to each other via sound waves. Both phenomena keep the defects from interfering with sound waves, allowing the waves to travel long distances.

Understanding how two level systems work has applications in creating better superconducting quantum computers, which use glasses as insulators and operate at low temperatures.

H. M. Carruzzo, & C. Yu, “Why Phonon Scattering in Glasses is Universally Small at Low Temperature.” Phys. Rev. Lett. **124**, 075902 (2020), DOI:10.1103/PhysRevLett.124.07590



2 two level systems exchange a sound wave