

Helmholtz oscillator: An oscillator generating an unexpectedly low frequency

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Low frequency earthquakes are considered to occur as the free oscillation of fluid bodies in the depths. The fundamental frequency is estimated by the ratio of the characteristic length of the oscillating body and the elastic wave velocity. I would like to show an oscillation phenomenon that

is very familiar to us and generates an unexpectedly low frequency.

When we blow the mouth of a bottle, the dominant frequency is significantly lower than the frequency expected from the ratio of the length and the sound velocity. This is called Helmholtz oscillator.

When we blow, the air in the neck is pushed down and the air in the body is compressed. It is then pushed up by the compressed air, and passes by the equilibrium position. It is pulled down by the decompressed air in the body. The system acts like a spring pendulum. The characteristic frequency

is given by $(c/2\pi)(S/Vl)^{1/2}$, where S , V , l and c are the neck cross-sectional area, the volume of the body, the neck length and the sound velocity, respectively.

I would like to discuss the application of Helmholtz oscillator to low frequency earthquakes.