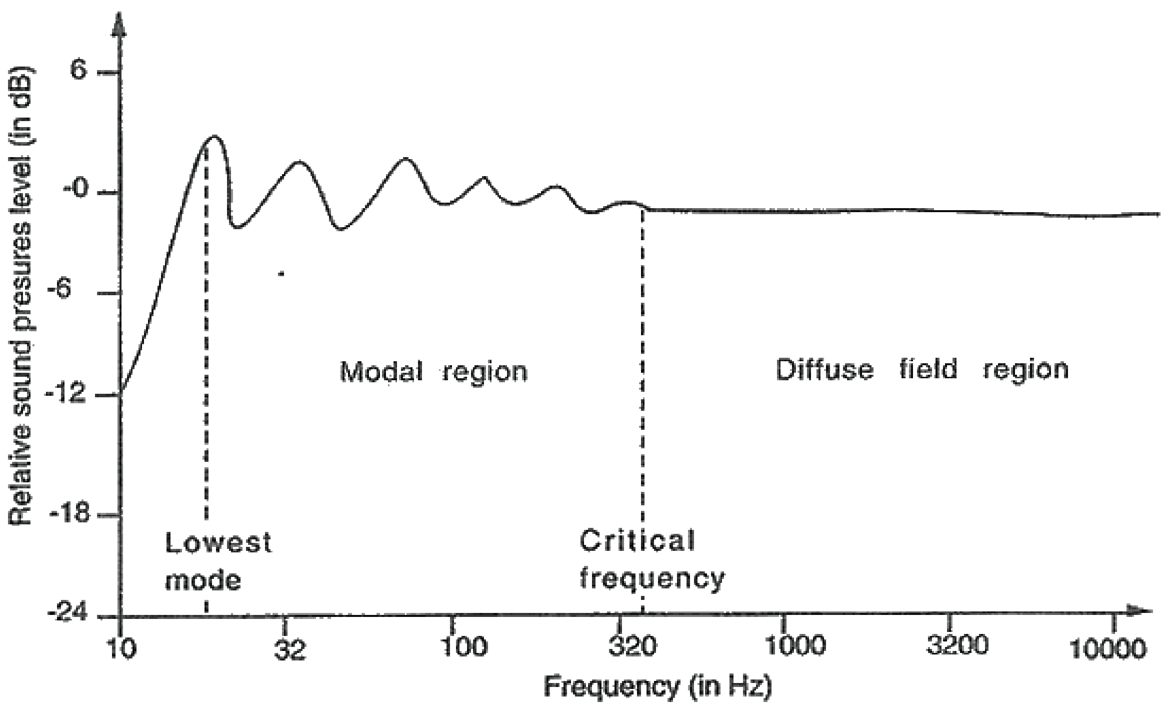
It can be seen from the above figure that rectangular rooms are acoustically preferable to cubical rooms, for this reason. Room with *e.g.* a *L*:*W*:*H* dimensions in the ratio of 5:3:2 are noted for their smooth response in this regard, because it avoids the degeneracies associated with having two (or all 3) of the room dimensions being equal to each other. Other non-integral ratios will also work well; one famous, often-used ratio, not just for rooms/auditoriums, but also *e.g.* speaker enclosures, is the so-called *golden* ratio 1.618 : 1 : 0.618 (= $\left(\sqrt{5}+1\right)/2 : 1 : \left(\sqrt{5}-1\right)/2$), which fascinated the ancient greek mathematicians – *e.g.* Pythagoras and Euclid, as well as Fibonacci, Kepler, and more recently, Roger Penrose with his mathematical development of quasi-crystals and Penrose tiles…

Note also that in the figure above, the 3-D room resonances/room modes are not infinitely sharp – each resonance at a given frequency f_{lmn} will in fact have a finite, frequency-dependent width $\Delta f_{lmn}\left(f_{lmn}\right)$ associated with it, due to the frequency-dependent nature of the absorption, $A(f)$ of the room, and for the lowest modes, which are 1-D axial and/or 2-D tangential in nature, the $A(f)$'s associated with specific opposing walls for these low-mode standing waves.

The Overall Frequency Response of a Room/Auditorium:

For a room/auditorium of dimensions{*L* x *W* x *H* } = {L_x, L_y, L_z}, a cutoff frequency f_C exists for the room, which is equal to the resonant frequency of the lowest axial room mode, *i.e.* $f_C = f_{100} = v/2L_x$ {with $\lambda_{100} = 2L_x$ }, below which standing waves cannot exist, and the reverberant room response drops off with decreasing frequency, as shown in the figure below:



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