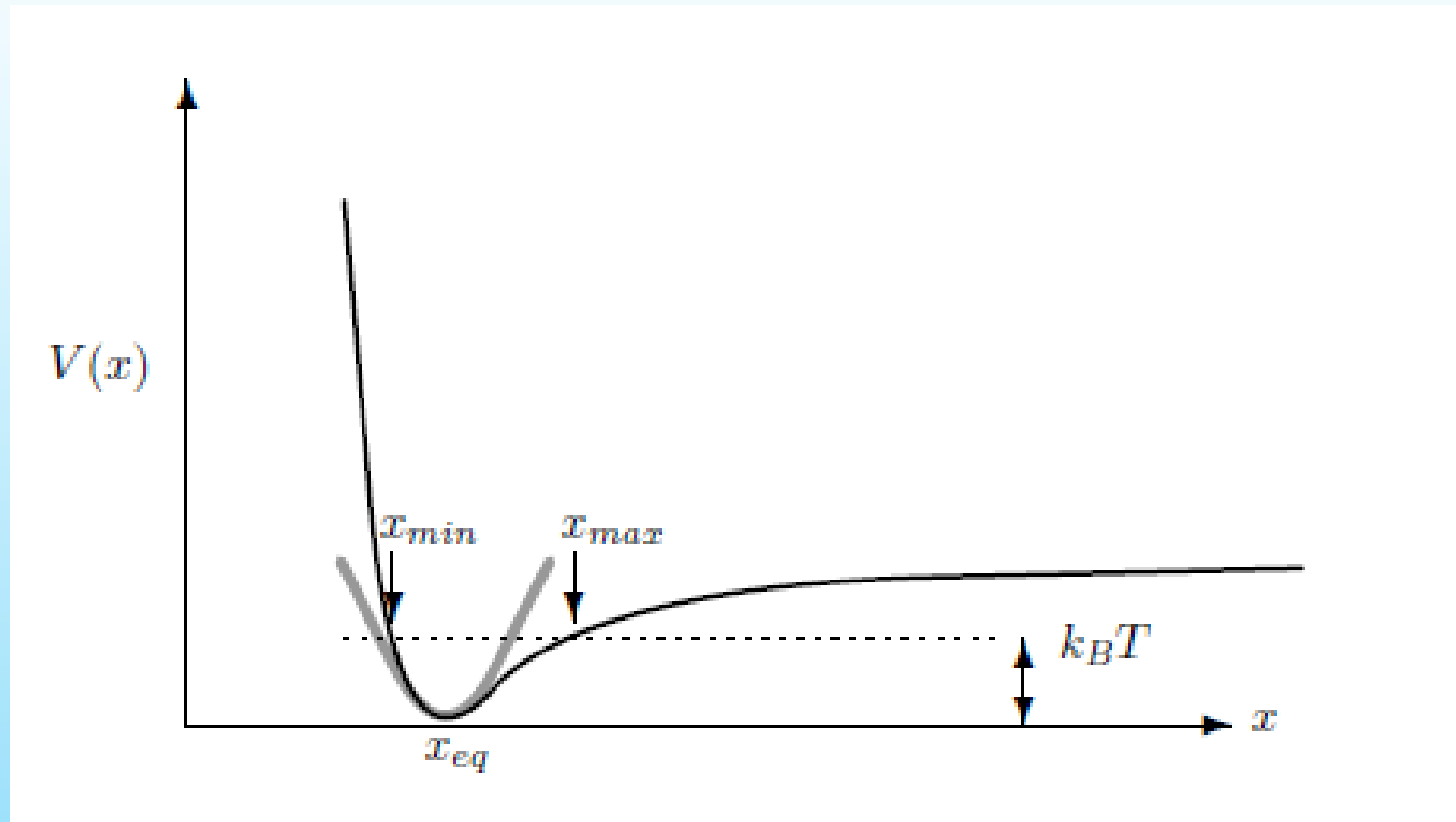
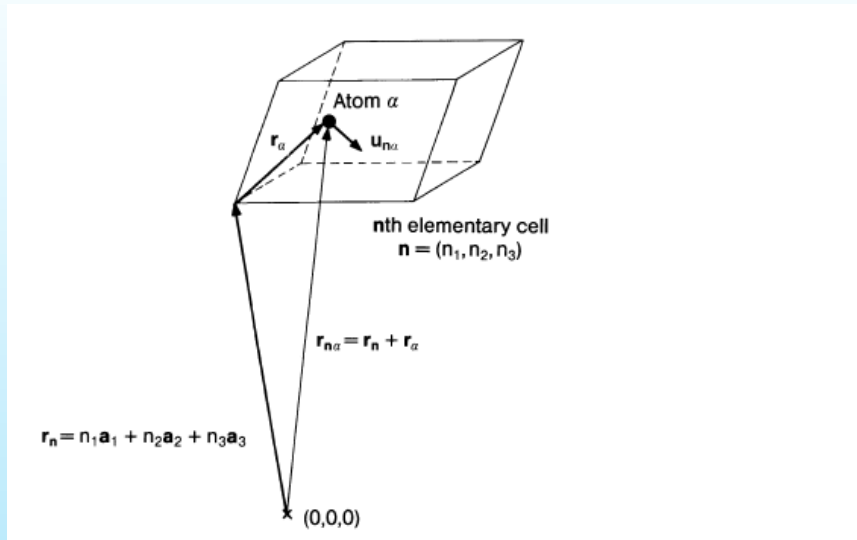




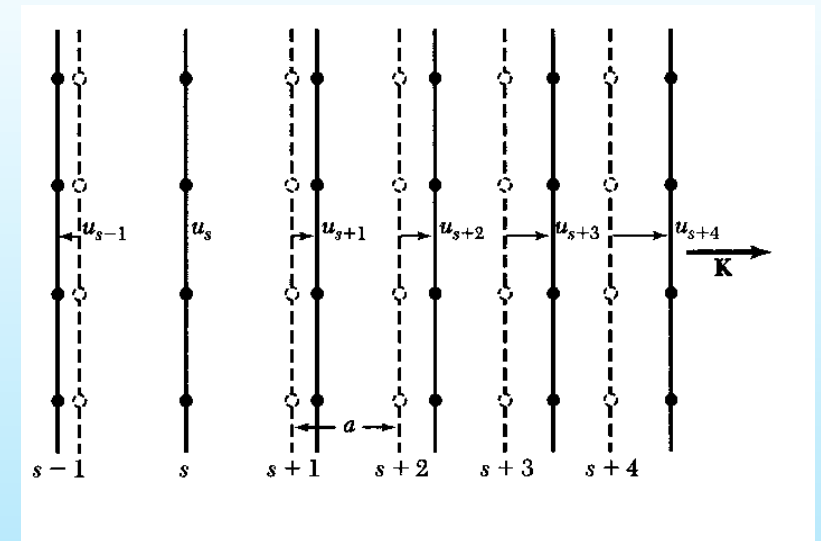
Vibraciones de la red



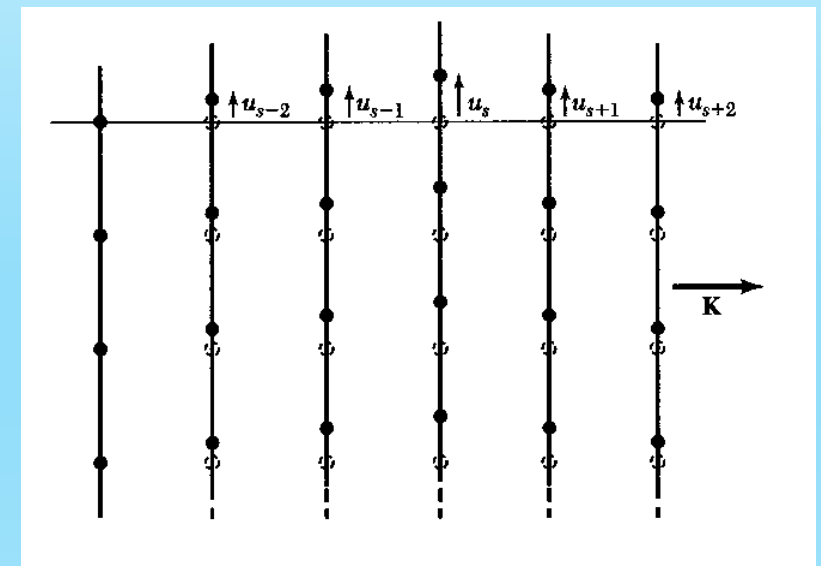
Potencial entre átomos vecinos 1D

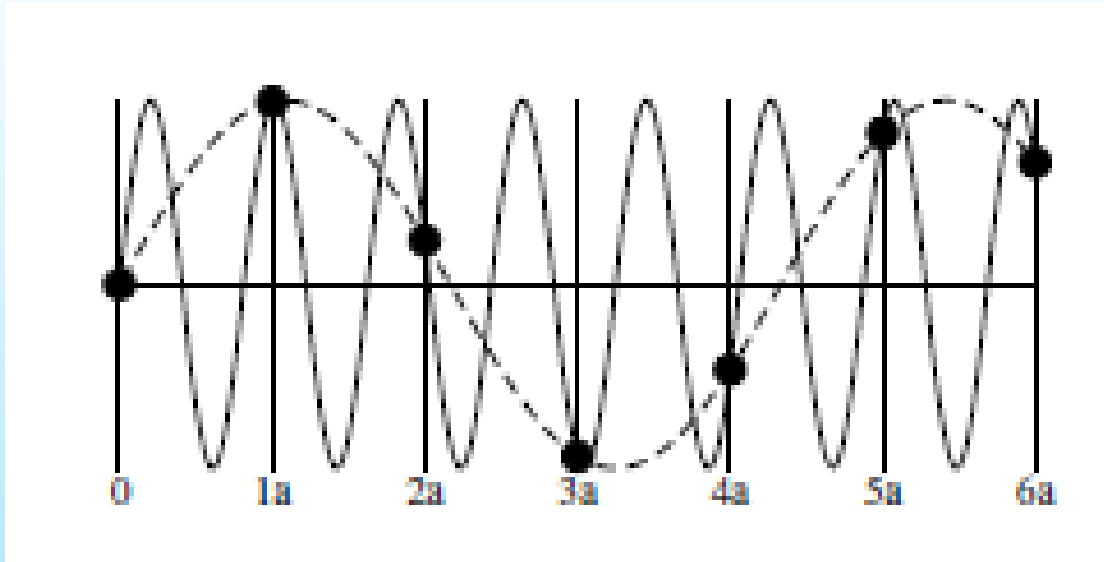


onda longitudinal



onda transversal





Linea discontinua: vector de onda: k

Linea solida: vector de onda: $k + 2\pi/a$

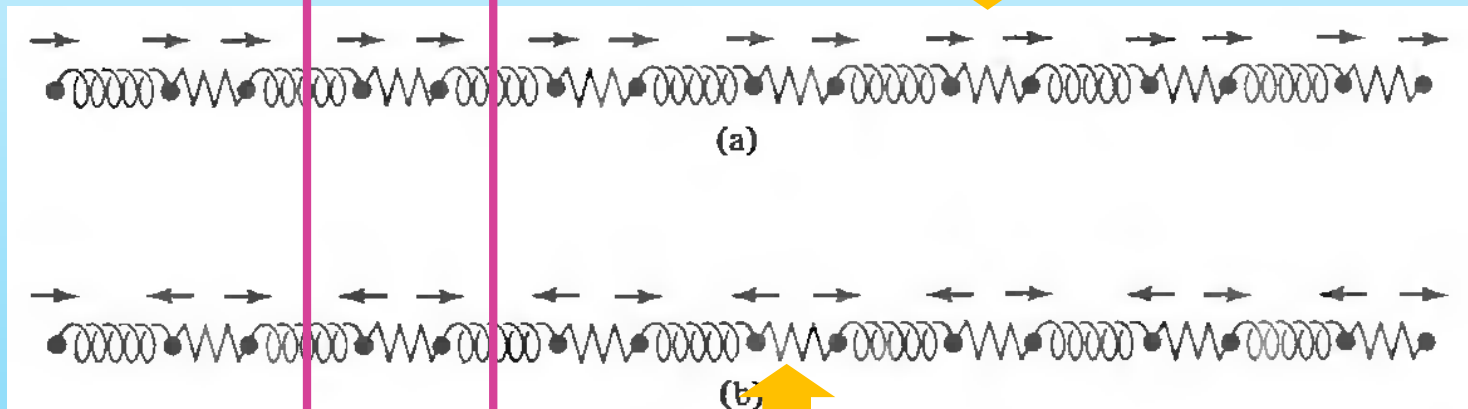
Las curvas con vector de onda k y $k + 2\pi/a$ coinciden solamente en $n \cdot a$

Porque?

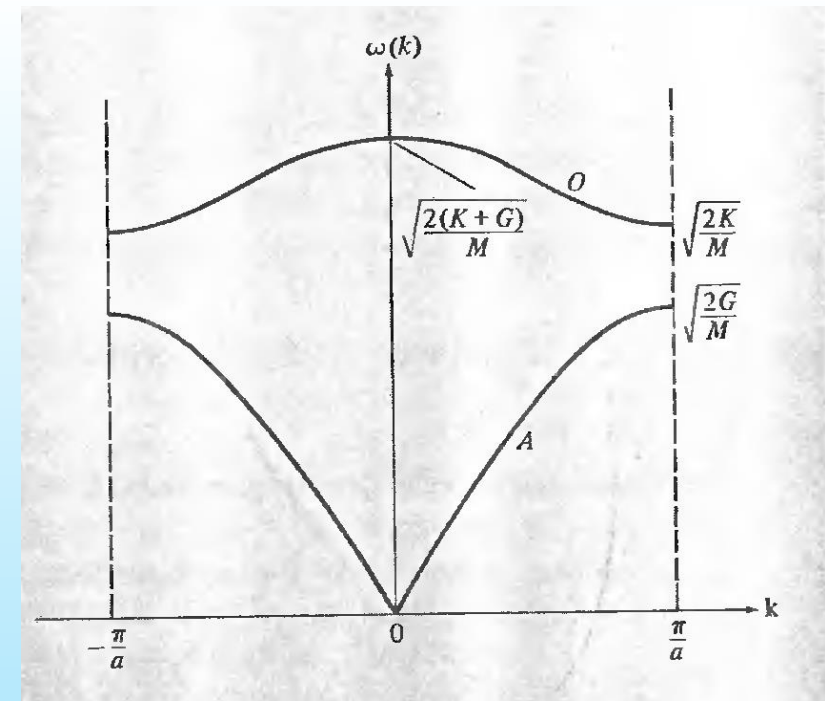
Recordar que definimos: $\delta \mathbf{x}_n = \mathbf{A} e^{i\omega t - i k n a}$

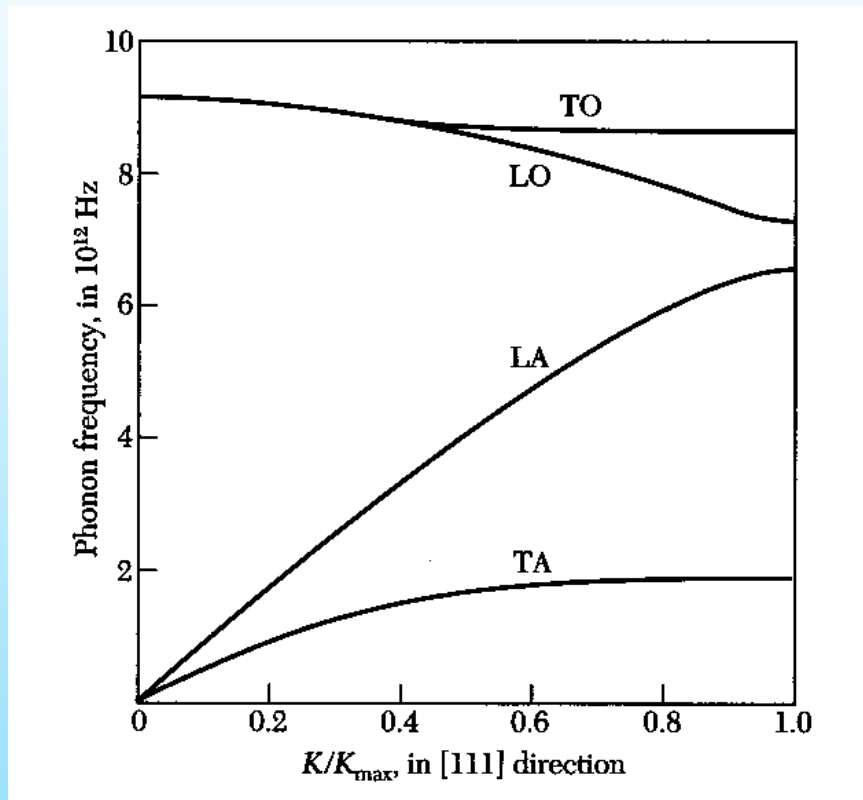
OJO! la red es discreta: X asume valores discretos

Modo acústico

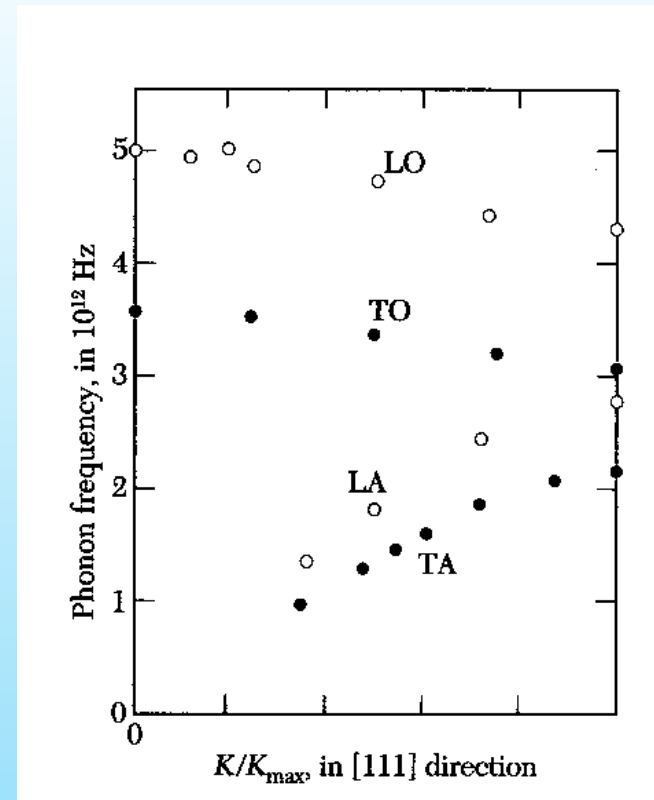


Modo óptico

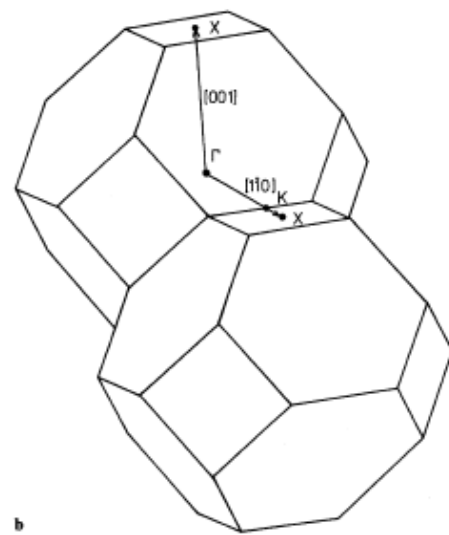
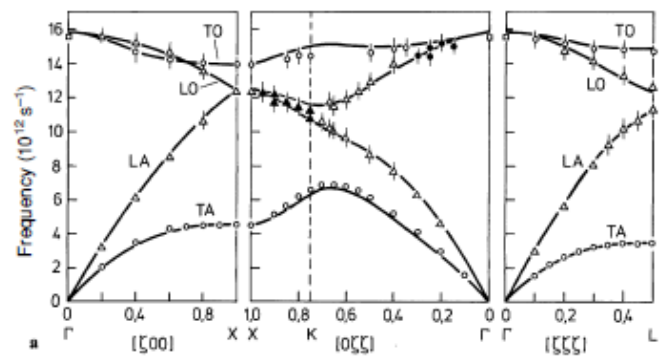


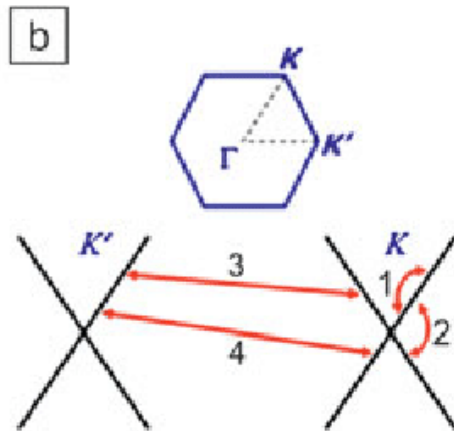
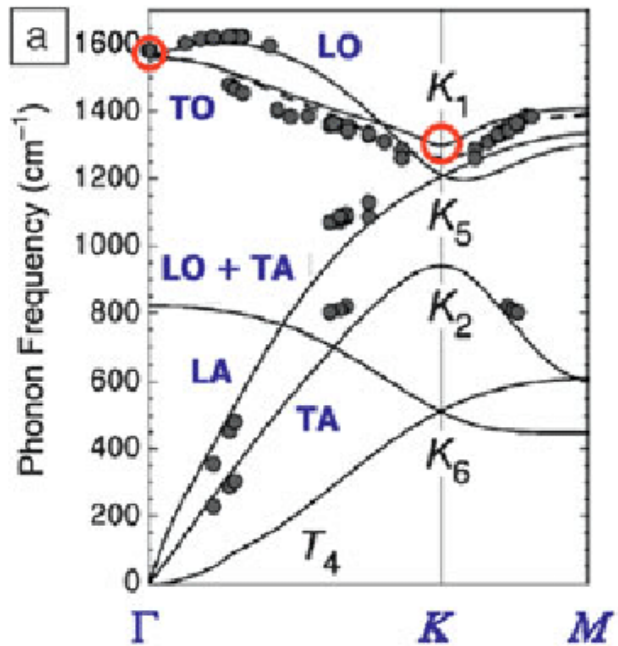


Relación de dispersión del Ge, medida a 80K y a lo largo de la dirección [111]. C. Kittel

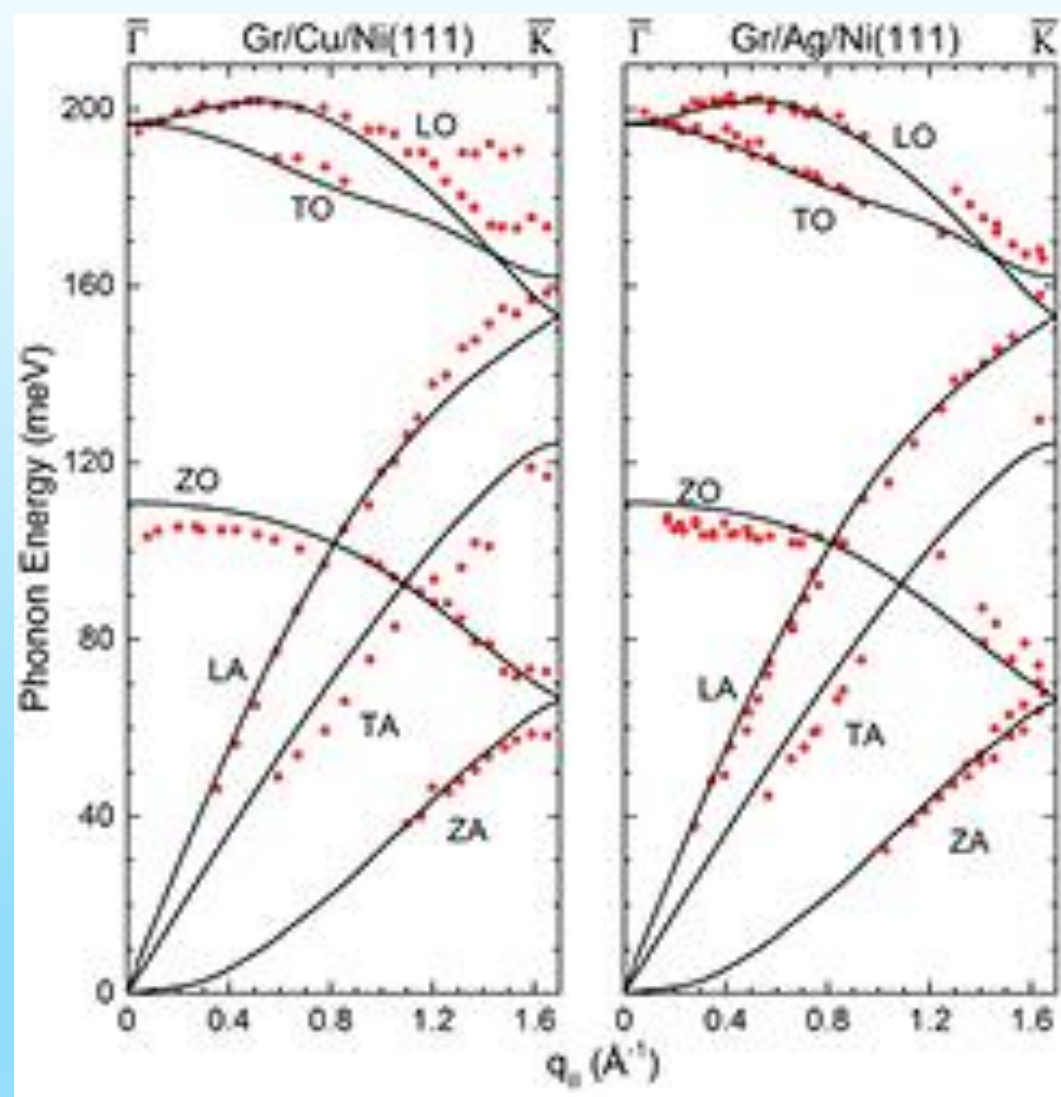


Relación de dispersión del KBr, medida a 90K y a lo largo de la dirección [111]. C. Kittel





Vibraciones en grafeno



Conductividad termica

