Barisic, Labbe and Friedel [45] presented a simple and strong argument for transition metals and compounds on the basis of the tight binding representation of the band-structure and of the electron-phonon coupling that $N(0) < I^2 >$ is related simply to the cohesive energy E_c of the metal. The argument is summarized in appendix A with the conclusion that

$$N(0) < I^2 > \approx N(0) < d^2E_c/dR^2 > \approx N(0)E_c/r_0^2. \tag{27}$$

$< d^2E_c/dR^2 >$ is the average of the second derivative of the change in kinetic energy of the metal as the nearest neighbor distance between two atoms R is changed leaving the others fixed; r_0 is the size of the typical metallic orbital.

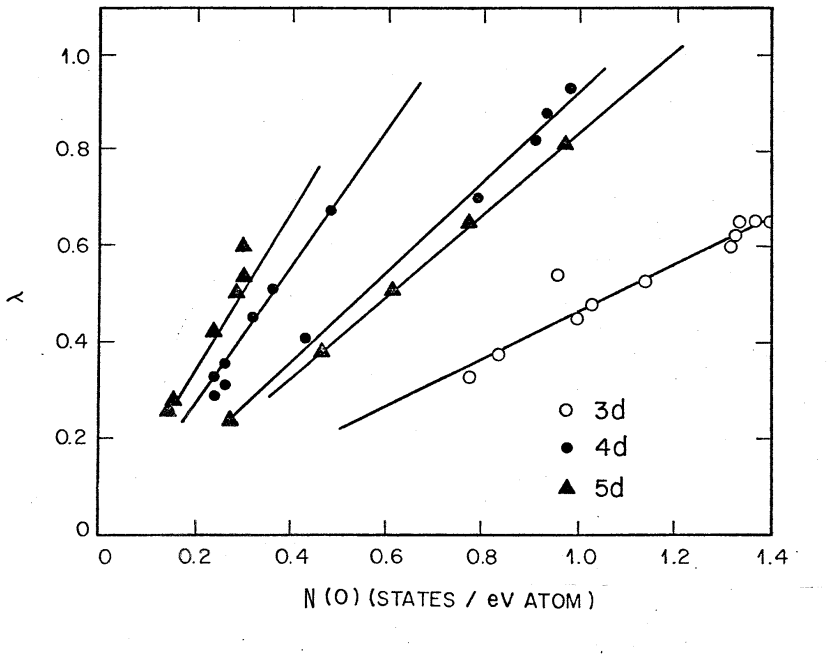

FIG. 6: Empirical Relation between experimentally deduced λ and the bare electronic density of states at the chemical potential in 3d-4d and 5d metals and their alloys.

One may be tempted to conclude that since $N(0) < I^2 >$ within a given class of transition metals or compounds is approximately a constant, one may simply increase λ by reducing the average lattice stiffness $M < \omega^2 >$ and thus increase T_c. This led to the soft-phonon myth, much propagated in the 1970's . Quite apart from the fact that the prefactor $< \omega >$ would prefer matters the other way for high T_c, there is also another empirical rule [46, 47] followed. It is that within a given class of materials $< I^2 > /(M < \omega^2 >)$ is also approximately a