Role of the surface electronic structure in the enhancement of quantum friction between parallel silver slabs

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In the framework of the recent debate [1, 7] about the existence and formulation of quantum friction between two moving metallic slabs, we provided a new, more efficient formulation and applied it to the investigation of the role of realistic electronic structure to friction between two silver slabs in relative motion. The results are compared with those of the Drude and jellium models. We show that low energy electronic excitations play a dominant role in the description of quantum friction, i.e. that the Drude model, because of the absence of low energy electronic excitations, is a completely inappropriate model in the description of friction phenomena. On the other hand, the jellium model, because of the absence of surface states (which reduce low energy electron hole intensity), and absence of low energy surface plasmons [9], gives a significant reduction of the frictional force. We show that in the range $0 < v < v_F$, the friction force shows an v^{α} dependence whereas in the jellium model $\alpha = 3$ and for a realistic model potential [10] $\alpha = 4$. Because quantum size effects strongly modified low energy electronic excitations [8], we provided an analysis of quantum friction as function of slab thicknesses.

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