

# Surface-induced resistivity of gold films on mica: Comparison between the classical and the quantum theory

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We report an extension of the theory of Sheng, Xing and Wang (SXW) (Sheng L, Xing D Y and Wang Z D 1995 Phys. Rev. B 51 7325), which permits the calculation of size effects from the statistical properties that characterize the surface on a microscopic scale, for samples in which the average height-height autocorrelation function (ACF) is described either by a Gaussian or by an exponential. We also report measurements of the topography of a gold film deposited on a mica substrate using a scanning tunnelling microscope (STM) on a gold sample 70 nm thick deposited under ultrahigh vacuum on a mica substrate preheated to 300°C. From the STM images we compute the average ACF which characterizes the surface of the film on the scale of 10 nm × 10 nm, and determine by least-squares fitting the r.m.s. amplitude  $\sigma$  and the lateral correlation length  $\lambda$  corresponding to a Gaussian and to an exponential that best represent the ACF data. Using the modified SXW (mSXW) theory and a Gaussian and an expon