Wahl *et al.* Reply: In our Letter [1] we have used low temperature scanning tunneling spectroscopy to measure the phase coherence length of electrons in image-potential states as a function of energy. To that end we *defined* the phase coherence length to be given by the spatial decay of the wave function $\psi(x)$ rather than $|\psi(x)|^2$. This operational definition was also used in other papers using the method [2,3]. In their Comment Crampin *et al.* [4] correctly point out that, if the thus defined coherence length is converted into linewidths in the way we have done in our Letter, it becomes inconsistent with linewidths defined in photoemission spectroscopy experiments as the STM linewidths should be multiplied by two. The same factor arises in the case of the present comparison to the two-photon photoemission spectroscopy (2PPE) experiments in Ref. [5] where the linewidths are obtained from the temporal decay of the population of the image-potential state which is *defined* to be proportional to $e^{-\Gamma t/\hbar}|\psi(t=0)|^2$. However, Fig. 1 of the Comment by Crampin *et al.* might be taken to suggest that the decay of the local density of states (LDOS) interference pattern is physically different from what we have experimentally determined. This is, of course, not the case; with the values and the definitions given in our papers it is perfectly possible to obtain the physically relevant, true wave pattern decay. The only difference is the number that is extracted from it.

Turning to the comparison of our data with the 2PPE data of Ref. [5] even with the inclusion of the factor 2, the measured values still demonstrate the same physical mechanisms behind the loss of phase coherence as observed by STM and the population decay as observed by 2PPE. As discussed by Berthold *et al.*, the decay of the image-potential state population is given by interband scattering into the bulk and to a large extent by intraband scattering for $k_\parallel \neq 0$. The interband scattering is given by the bulk penetration p of the state at the crystal surface that can be defined as [6]

$$p = \int_{\text{bulk}} \psi(z)^* \psi(z) dz, \tag{1}$$

where $\psi(z)$ is the image-potential wave function. If we use the model potential to obtain the image-potential wave functions in the presence of the STM tip [1], p increases by a factor 2.2 for the $n = 1$ state. Because of the strongly confining nature of the tip potential the wave functions have a higher amplitude in the bulk. On the other hand, the intraband contribution should be unchanged since intraband scattering depends on the overlap of image-potential wave functions for different $k_\parallel$. These are all equally
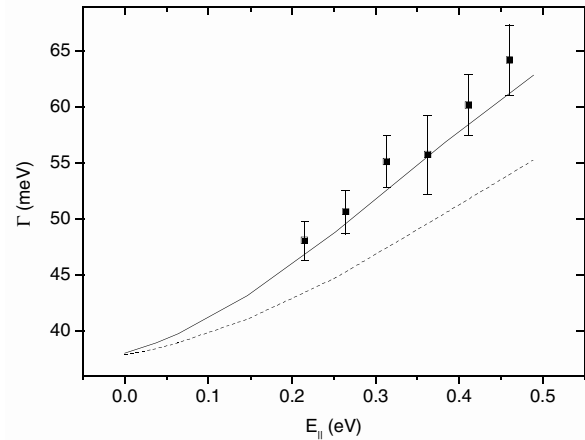

FIG. 1. Comparison between the measured linewidths Γ_{STM} (including the missing factor 2) and the sum (solid line) of the interband (dashed line) and intraband contribution based on 2PPE experiments. The theoretical curves were obtained by scaling the calculated interband contribution from Ref. [5] with 2.2 (see text).

affected by the tip potential. The interband and intraband contributions were calculated by Berthold *et al.* in agreement with their 2PPE data. If we consequently multiply the interband contribution by 2.2 and keep the same intraband contribution as Ref. [5] we obtain good agreement with the linewidths we should have extracted from our STM data as shown in Fig. 1.

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