Giesen and Ibach Reply: We are glad to see that the rapid island decay is now also observed by other groups. While the effect as such is well established the mechanism is still in question. On Cu(111), the rapid decay begins at a critical mean distance w_c of about 1.4 nm [1]. The distance is independent of temperature and the decay can be quantitatively accounted for by assuming that the Ehrlich-Schwoebel (ES) barrier vanishes for terrace widths below w_c. We have now extended our studies to Ag(111) [2]. As in the case of Cu, we find that rapid decay sets in at a distance which is independent of temperature. Figure 1 shows decay curves of a double layer island at 303 K. Both islands decay, the upper one with a smaller rate of -0.07 atoms/s. As the terrace width between the islands decreases the decay rate increases to -0.53 atoms/s. From there on, the mean terrace width stays constant at about 1.5 nm. The initial decay is quantitatively described by diffusion limited decay in the presence of an ES barrier (dashed line; see [1] for details) with the parameters taken from Morgenstern *et al.* [3] and no parameter fitted to this data. The agreement is excellent until the terrace width approaches a critical distance of 1.5 nm. If none of the parameters would change, the terrace width would drop to zero and the upper island would decay as permitted by the lower island. As in the case of Cu, the rapid final decay is quantitatively described by assuming that the ES barrier vanishes at $w_c = 1.5$ nm (solid lines in Fig. 1) [2].

For Cu(111), $w_c = 1.4$ nm is precisely the distance where the occupation of the surface state vanishes because of quantum confinement. However, for Ag(111) the surface state occupation vanishes [4] at about 6 nm at 300 K (and the distance increases substantially with T). Hence, our data for Ag are incompatible with the proposition that the rapid decay effect is related to the surface state. The physical origin of the rapid decay effect is therefore still in question. A common feature for Ag(111) and Cu(111) is the temperature independence of w_c and that w_c amounts to the same number of six atom rows. The magnitude of w_c seems to exclude microscopic models which involve nearest neighbor configurations of the steps. A process involving an immersion of a kink atom into the step edge of the lower island next to a kink as proposed by Bartelt in 1997 [5] was therefore not explored further. We note the data can also be fitted by assuming that the activation energies for adatom creation and/or for terrace diffusion are reduced at w_c by about 0.1 eV or more. The reduction could extend over a certain distance range. The origin of this reduction could be related to the overlap of strain fields arising from the steps and also to a lateral extension of the ES barrier [6]. Strain fields were considered to be responsible for rapid mass transport between vacancy islands on Ni(100) [7].

In their Comment, Morgenstern *et al.* [8] report the decay of a vacancy island at 300 K and a rapid decay event at 240 K. The data in their Fig. 1a are not at variance with our results in Fig. 1. We agree with the conclusion that w_c is smaller than the distance for electronic confinement. We do not agree with the argument of Morgenstern *et al.* that a breakdown of the ES barrier "would merely add an extra sink to already existing sinks." In the absence of an ES barrier, the decay rate is proportional to the inverse of the distance, in the macroscopic description of diffusion limited decay. Since the island considered in Fig. 1b of their Comment is very close to the step edge the decay rate should become noticeably larger [9]. We note furthermore that the estimate of the decay rate performed by Morgenstern *et al.* takes the macroscopic theory to the extreme limit of a one atom wide terrace. We doubt that the continuum model of diffusion limited decay used for the estimate is valid under these circumstances.

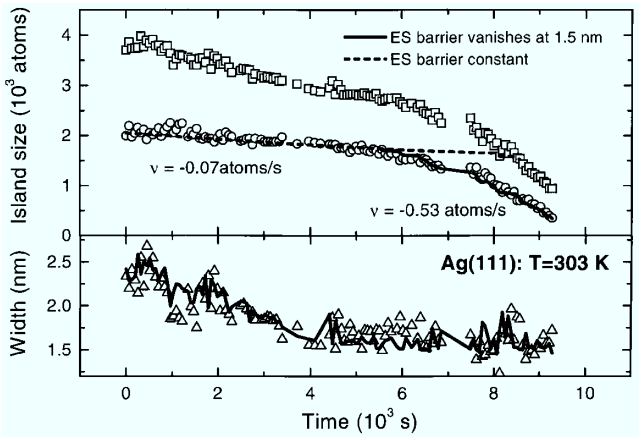

FIG. 1. Island area and terrace width vs time.

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[1] M. Giesen *et al.,* Phys. Rev. Lett. **80**, 552 (1998); **82**, 3101 (1999).
[2] M. Giesen *et al.* (to be published).
[3] K. Morgenstern *et al.,* Phys. Rev. Lett. **76**, 2113 (1996); **80**, 556 (1998).
[4] S. D. Kevan and R. H. Gaylord, Phys. Rev. B **36**, 5809 (1987); R. Paniago *et al.,* Surf. Sci. **336**, 113 (1995).
[5] N. C. Bartelt (private communication).
[6] K. Kyuno and G. Ehrlich, Phys. Rev. Lett. **81**, 5592 (1998).
[7] M. S. Hoogeman *et al.,* J. Phys. Condens. Matter **11**, 4349 (1999).
[8] K. Morgenstern *et al.,* preceding Comment, Phys. Rev. Lett. **85**, 468 (2000).
[9] M. Giesen, Surf. Sci. **441**, 391 (1999).

