Yang et al. Reply: We are glad to respond to the interesting Comment by Kash [1] on our Letter [2]. Our model, described in detail in Ref. [3], states that while the exciton absorption profile is obtained from the spatial inhomogeneous broadening (distribution) of the optical band gap of a quantum well material, the luminescence profile mirrors the inhomogeneous broadening of classically localized excitons, on the assumption that there are no transitions between localized states.

In order to discuss Kash's comment on the dynamics of exciton relaxation, it is important to distinguish two different processes: (i) hot excitons relax by losing kinetic energy (see, for example, [4]) to occupy local minima within a few tens of picoseconds or less, whereas (ii) classically localized excitons relax further by phonon-assisted hopping or tunneling between minima on a much longer time scale. Our Letter discussed the energy distribution of localized exciton states and assumed that the latter processes could be ignored. The decay time for exciton luminescence is an order of magnitude larger than that of the first process [4], so that relaxation into local minima is essentially complete before significant luminescence occurs. Kash points out that spectral diffusion is observed in certain samples during time-resolved luminescence, i.e., the Stokes shift between absorption and emission peaks is itself a function of time. He deduces that the near universal behavior explained by our model must provide only an approximate description, because the exciton relaxation is not completed before emission occurs.

It is certainly the case that, as stated by Kash, samples where slow spectral diffusion is dominant will not conform to our model. The successful fit of our model to data from a wide range of samples suggests that in many cases the effect of these slow processes is in fact small, and that the shape of the emission spectrum therefore is not usually dominated by dynamical effects. Because of the lack of relevant time-resolved spectroscopic information on large numbers of samples, it is difficult to predict which samples will show a substantial slow-relaxation effect and hence not conform to our predicted S/W relation. It is, however, possible to make a comment on this point, based on existing spectroscopic data. Reviewing Fig. 2 in our Letter [2], samples of small linewidth W show Stokes shifts S which are uniformly slightly higher than are predicted by our model, while data for samples with larger linewidth agree well with the prediction. We offer a tentative interpretation of this as follows. A small "excess" Stokes shift is a marker for slow-relaxation processes, which can presumably occur more easily in systems with smaller inhomogeneous broadening, because the potential wells trapping the excitons are shallower.

We would also like to comment on the relevance of the resonant Rayleigh scattering technique, which has been used by Hegarty and Sturge [5] as a probe of exciton dynamics. Resonant Rayleigh scattering from an exciton is proportional to its homogeneous lifetime, which is much longer for excitons trapped in local minima of their potential energy function. We hypothesize that in systems where the slower relaxation processes may have a significant effect, the resonant Rayleigh scattering may be closer to the density of minima (our analytical result) than is the luminescence spectrum. From Fig. 2 of Ref. [5] we find that the absorption linewidth is $W = 4.2$ meV, the Stokes shift for luminescence is $S_{lum} = 3.1$ meV, and the Stokes shift of the Rayleigh scattering data is $S_{Ray} = 2.3$ meV. The ratio $S_{Ray}/W = 0.55$ is in excellent agreement with our predicted value of 0.553, whereas the luminescence peak shows a small additional redshift which marks the spectral diffusion of localized excitons.

In conclusion, we believe that we have answered the question abut the spectral diffusion of the exciton in a time scale comparable to the luminescence decay time, and explained the relation of such diffusion to the results of our static model. Concerning the other point raised by Kash, the deposition of atoms is certainly a random process, and some degree of disorder in the effective well widths is unavoidable. Our model applies to the large class of samples which have an approximately Gaussian absorption profiles due to inhomogeneous broadening.

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