Zachai *et al.* Reply: In a recent Letter[1] we reported on the first observation of superlattice-related photoluminescence (PL) in the energy range around 0.8 eV from strained-layer, short-period Si/Ge superlattices (SLS's) grown on (001) Si substrates. The PL results were related to the fundamental zone-folded direct band gap predicted in Si/Ge SLS's with a period of ten monolayers (ML).[2] The strongest luminescence was observed at about 0.84 eV from a strain-symmetrized Si_6Ge_4 SLS [(6 ML Si)/(4 ML Ge)].

The authors of the preceding Comment[3] calculated the band structure of the strain-symmetrized Si_6Ge_4 SLS by means of a local-density-functional method (LDA) combined with a semiempirical determination of excitation energies. They believe that the observed PL cannot be assigned to the quasidirect band gap of the SLS. Their arguments mainly rely on the discrepancy of about 250 meV between the estimated LDA superlattice band gap (1.08 eV) and the experimental transition peak energy (0.84 eV). They suggest that the SLS luminescence originates in dislocation luminescence (D_2 line), which was observed at about the same energy in a liquid-phase-epitaxially (LPE) grown $Si_{0.6}Ge_{0.4}$ alloy layer.[4]

We do observe similar luminescence features from a corresponding $Si_{0.6}Ge_{0.4}$ alloy-layer reference sample as in Ref. 4. This alloy reference sample was grown immediately after the preparation of the strain-symmetrized Si_6Ge_4 SLS in the same molecular-beam-epitaxy chamber on nominally the same buffer layer. The density of dislocations is expected to be of the same order of magnitude in both samples. In Fig. 1, we show both the SLS luminescence (lower part) and alloy-layer luminescence (upper part) for direct comparison. The signal at about 1.1 eV (Si-Sub) is the well-known phonon-assisted excitonic luminescence from the Si substrate. The energetic positions of the PL signals measured by Weber and Alonso[4] in the LPE-grown alloy layer are indicated by arrows. They attributed their alloy luminescence signals to dislocation-related transitions (D1 to D4, below 0.95 eV) and phonon-assisted bound-exciton transitions (BE, 0.96 eV). The much stronger intensity (factor of 10–20, see scaling factor in the upper part) and the completely different spectral behavior of the SLS luminescence strongly indicate that the superlattice luminescence cannot be assigned to alloy-related dislocation transitions.

The LDA calculations predict the fundamental quasidirect band gap at 1.08 eV. However, no superlattice-related PL is observed near this energy. Since excitonic phonon-assisted interband transitions are observed even in the indirect Si-Ge alloy layer (BE in the upper part of Fig. 1), one expects to measure interband transitions also in the superlattice. This is in disagreement with the theoretical interband energy calculated by the authors of the Comment. Furthermore, the observed redshift of the SLS luminescence with increasing strain in the Si layers and the absence of strong luminescence in a 20-ML period SLS[1] agree well with the predictions of other theoretical groups.[2] Consequently, we still believe that our experimental results support the prediction of a fundamental quasidirect band gap with enhanced dipole-allowed transition rate.

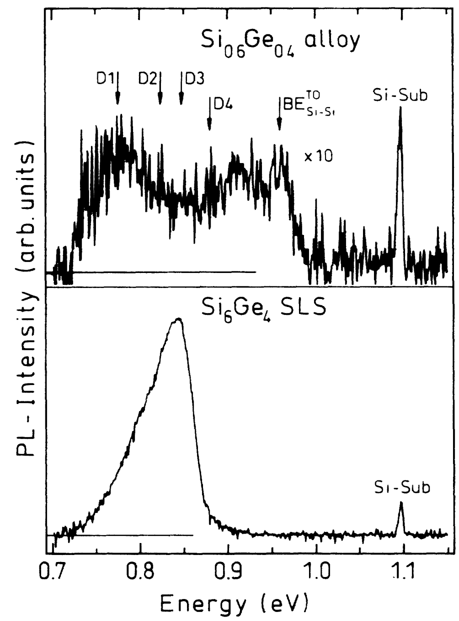

FIG. 1. Low-temperature ($T \approx 5$ K) photoluminescence spectra from a strain-symmetrized Si_6Ge_4 superlattice ($\epsilon_\parallel^{Si} \approx 1.4\%$, $\epsilon_\parallel^{Ge} \approx -2.7\%$) (lower part) and from the corresponding $Si_{0.6}Ge_{0.4}$ alloy-layer reference sample (upper part) measured under the same experimental conditions. The arrows mark the energetic positions of the luminescence features observed from a LPE-grown $Si_{0.6}Ge_{0.4}$ alloy layer (Ref. 4).

R. Zachai,[(1),(a)] K. Eberl,[(1)] G. Abstreiter,[(1)]
E. Kasper,[(2)] and H. Kibbel[(2)]
[(1)]Walter Schottky Institut
Am Coulombwall
D-8046 Garching, Federal Republic of Germany
[(2)]Daimler-Benz Research Center
Oberer Eselsberg
D-7900 Ulm, Federal Republic of Germany

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[(a)]Present address: Daimler-Benz Research Center, Oberer Eselsberg, D-7900 Ulm, Federal Republic of Germany.

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