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Unusual compositional dependence of the exciton reduced mass in GaAsBi

Abstract: We report the compositional dependence of the exciton reduced mass, mexc, of GaAs1-xBix in the largest Bi concentration range available for this material (x=0÷10.6%). Photoluminescence under high magnetic fields (B up to 30 T) shows that mexc increases rapidly until x~1.5% and oscillates around its maximum value (~ 0.08 m0, m0 being the electron mass in vacuum) up to about x=6%. Surprisingly, for x>8% the exciton reduced mass decreases below the GaAs value, in agreement with the expectations of a k.p model. Such a behavior reveals the existence of different concentration intervals, where continuum states of the valence and conduction band hybridize with Bi-related levels at different extents, which confer to the band edges a localized or bandlike character for x<8% and x>8%, respectively.