

Abstract Submitted
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Single-valley (110) and double-valley (001) AlAs quantum wells

S. DASGUPTA, A. FONTCUBERTA, M. BICHLER, G. ABSTREITER, Walter Schottky Institute, TU Munich, Germany, M. GRAYSON, Walter Schottky Institute, TU Munich, Germany & Dept. of Electrical Engineering and Computer Science, Northwestern University — Doubly-degenerate valley quantum number in (001)AlAs quantum wells (QWs) functions as pseudo-spin degree of freedom for understanding exchange interactions, and single valley anisotropic mass, if observed in high mobility (110)AlAs, could lead to interesting phases in quantum limit. We optimized growth of AlAs QWs [1], and grew (001) oriented double valley degenerate AlAs QW with density $n=2.4 \times 10^{11} \text{ cm}^{-2}$ and mobility $\mu=4.3 \times 10^5 \text{ cm}^2/\text{Vs}$ (330 mK), an improvement of almost an order of magnitude over published results. We also grew (110)oriented AlAs QW with $n=4.2 \times 10^{11} \text{ cm}^{-2}$ and $\mu=5.4 \times 10^4 \text{ cm}^2/\text{Vs}$ (330 mK). The (110)AlAs QW is predicted to occupy single valley, and anisotropic μ along two crystallographic directions of (100) & (1-10) may be expected. Experimentally, we observed μ anisotropy $\mu_{(100)}/\mu_{(1-10)}=1.6$ in dark(1.4 K) and strong odd-filling factor SdH gaps, evidence consistent with single valley occupancy. We studied μ on both growth facets as function of temperature. The μ of (110)AlAs QWs is seen to saturates below the Fermi temperature but (001)AlAs QW does not saturate. Possible causes will be discussed, and measurements down to 50 mK will be presented. [1] Dasgupta, *et al.* Appl. Phys. Lett. ('07)

Shivaji Dasgupta
Walter Schottky Institute, TU Munich, Germany

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