larger than the lower bound set by this short lifetime, which suggests that much of the remaining broadening results from nonidealities in the QW growth. Due to the fast recovery of the exciton bleaching, Ge/SiGe QWs could be used as a saturable absorber in future mode-locked lasers. The saturation fluence was estimated to be between 0.11 and 0.27 $pJ/\mu m^2$.

Following the fast exponential decay that occurs primarily through intervalley scattering, field screening occurs. To accurately model this, we combined the effects of carrier escape time from the QWs, the time it takes the carriers to drift across the device, and the recovery of the applied voltage through diffusive conduction. We see evidence suggesting the carriers may take a short time (~4 ps) to be emitted from the wells, as well as evidence of the electrons and holes transporting with somewhat different effective saturated drift velocities through the structure. The device recovers fully within 120 ps, indicating that, though the intervalley scattering time is extremely fast and represents a fundamental limitation of the speed of the QCSE in our modulators in the THz range, the actual limitation comes about from the time it takes for the device to completely recover via diffusive conduction. This recovery time could be shortened (effectively decreasing the *RC* constant of our device) by increasing the dopings of the n and p regions, decreasing device size, and decreasing the device capacitance.

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