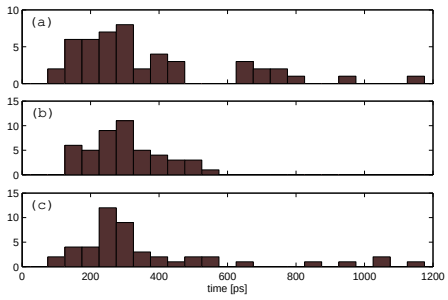

FIG. 2: Histograms of the 'off' state 1/e decay times of (a) 3.8nm QDS, (b) 5nm QDs and (c) 8nm QDs.

times in the 'off' state. In Fig. 3 we present two such examples of 'off' and 'on' decay transients for single QDs excited at several intensities, ranging from an average excitation rate of ~ 0.2 to ~ 1. The two QDs have a low intensity $1/e$ decay time of $\sim$ 2ns (Fig. 3i(a)) and $\sim$ 400ps (Fig. 3ii(a)). As can be seen, at an elevated excitation level a fast transient component emerges in the 'off' state decay traces. The multiexponential fit (Fig. 3c) gives the fast components lifetimes of (i) 82 $\pm$ 31ps and (ii) 68 $\pm$ 7ps, which, when taking into account the 65 ps instrument response, correspond to even shorter lifetimes. These values are in good agreement with the biexciton Auger decay rate of $\sim$ 30 ps for 3.8nm CdSe QDs [11]. The emergence of such a fast transient at high intensities is observed in all QDs of this size. In contrast varying the excitation rate at lower excitation intensities, below 0.1, revealed no significant change in the $1/e$ lifetime.

These observations can be summarized as follows: while the decay rates at low intensities are inconsistent with the assumption of Auger recombination driven decay, at elevated intensities the Auger process seems to become the dominant recombination channel.

One cardinal feature of the data, as can be seen in Fig. 3, is that in the 'off' state the onset of the fast decay occurs at excitation rates of order ~ 0.2, in contrast to the 'on' state, in which the Auger feature emerges when the excitation rate approaches unity. Based on this key observation, we wish to offer the following interpretation. The Auger component in the decay curve indicates the simultaneous presence of more than one pair of charge carriers. In the 'on' state, the extra charge carriers are provided by multiple excitation of QDs. In the 'off' time, however, the probability of multiple excitation is still low at the onset of the Auger recombination feature. Therefore, the additional charge taking part in