

## ABSTRACT:

In this paper, an all-optical switch based on self-assembled GaAs/AlAs quantum dots (QDs) within a vertical cavity is designed and proposed. Two essential aspects of this novel device have been investigated, which include the QD/cavity nonlinearity with appropriately designed mirrors and the intersubband carrier dynamics inside QDs. The vertical-reflection-type switches have been investigated with an asymmetric cavity that consists of 12 periods of GaAs/Al<sub>0.8</sub>Ga<sub>0.2</sub>As and 25 periods for the front and back mirrors, respectively. The thicknesses of the GaAs and AlGaAs layers are chosen to be 89 and 102 nm, respectively. To give a dot-in-a-well (DWELL) structure, the 65 nm dimension of Si was recommended to deposit within a 20 nm AlAs QW. Results obtained have shown that all-optical switching via the QD excited states has been achieved with a time constant down to 275-fs and over 29.5 nm tunable wavelengths. These results demonstrated that QDs within a vertical cavity have great potential to realize low-power, consumption polarization-insensitive and micrometer-sized switching devices for future optical communication and signal processing systems.