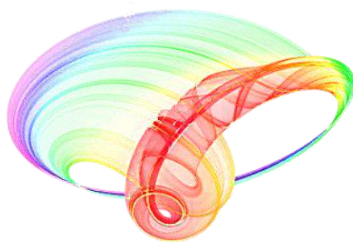


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Investigation of intersubband transitions in wide bandgap oxide quantum well structures for optoelectronic device applications

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There has been a surge of interest in recent years for the advancement of wide bandgap oxides such as zinc oxide (ZnO), magnesium oxide (MgO), gallium oxide (Ga₂O₃), etc. [1,2]. These materials have gained significant attention due to their distinctive characteristics and properties which are promising for the development of high-performance optoelectronic devices for applications in the domains of sensing, communications, and imaging. More specifically, Ga₂O₃ has wide bandgap energy of approximately 4.8 to 4.9 electron volts (eV), thus exhibiting exceptional transparency to ultraviolet (UV) radiation while displaying opaqueness to visible light [3]. On a parallel note, ZnO shows exemplary optical and electrical properties, including a high exciton binding energy and substantial oscillator strength [4]. Of particular significance is the exploration of intersubband transitions within multiple quantum well (MQW) structures, which offers a promising path for efficient light absorption and emission in the mid-infrared to terahertz spectral range.

In this contribution we will numerically simulate the absorption spectra of the wide bandgap oxide MQW structures, adapting the approach for treating the light-matter interaction suitable when the depolarization field is the dominant many-body contribution, and discuss the potential applications in optoelectronic devices, specifically mid-infrared detectors, quantum cascade lasers, and modulators.

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