UNIVERSITÀ DEGLI STUDI
DI TRENTO
Dipartimento di Fisica

Dr. Bülent Aslan

Department of Physics (Nanoscence Laboratory)

November 9th 2022 h 2.30 p.m.
(Room B107 – Povo 2)

"QUANTUM DOTS AND SEMICONDUCTOR SHALLOW IMPURITY LEVEL TRANSITIONS FOR TERAHERTZ GENERATION AND DETECTION"

Abstract:

The talk is designed in two sections; the aim of the first part is to make a brief acquaintance by articulating some previously studied subjects, academic interests and experiences of the speaker.
The second part forms the main line of the talk and focuses on the quantum dots and semiconductor impurity level transitions for terahertz (THz) applications.
Towards the realization of both detectors and emitters operating in the THz frequencies, semiconductor nanostructures, such as quantum wells (QW) and quantum dots (QD) have drawn a lot of attention. On the other hand, the intentionally doped impurities in semiconductors have also energy separations in the THz region and their radiative transitions are dipole allowed. Therefore, an alternative approach using hydrogen like energy levels of the shallow impurities in quantum wells has been proposed for both THz generation and detection. The binding energies of the ground (1s-like) and excited (2p-like) states of an impurity associated with the first subband in a quantum well depend on the quantum well width, position of the impurity in the well, as well as the type of the impurity. With these tuning capabilities, it is possible to cover a broad range of THz spectrum.
Additionally, structures involving self-assembled quantum dots with similar approaches for THz generation–detection will be briefly discussed in this talk. Potential advantages particularly in wavelength tunability (energy level engineering) make quantum dot structures a promising candidate for their use in THz applications. Experimental observations of the resonance tunnelling phenomenon through a self-assembled InAs QD layer and the impurity states in the quantum well will be presented as the first step for the ultimate goal of realizing a QCL-like emitter and lateral detecting device for THz frequencies.

Contacts:
Staff di Dipartimento di Fisica
0461 28-1504-1575-2042-1545-1219
df.supportstaff@unitn.it

Scientific Coordinator:
prof. Lorenzo Pavesi