

**Abstract:**

Positron annihilation spectroscopy is a powerful set of methods for the detection, identification, and quantification of vacancy-type defects in semiconductors [1]. In the past decades, it has been used to reveal the relationship between (opto-)electronic properties and specific defects in a wide variety of elemental and compound semiconductors. In typical binary compound semiconductors, the selective sensitivity of the technique is rather strongly limited to cation vacancies that possess significant open volume and suitable charge (negative or neutral).

Filip will present recent advances in combining state-of-the-art positron annihilation experiments and ab initio computational approaches. The latter can be used to model both the positron lifetime and the electron-positron momentum distribution – quantities that can be directly compared with experimental results. We have applied these methods to study a wide variety of semiconductor systems, including metal oxide semiconductors. I will discuss selected examples from our earlier work on ZnO, SnO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, and more recent work on Ga<sub>2</sub>O<sub>3</sub>.

[1] Filip Tuomisto and Ilja Makkonen, Defect identification in semiconductors with positron annihilation: Experiment and theory, Rev. Mod. Phys. **85**, 1583 (2013).