Understanding A_{Si}-Si_i-defects in frame of silicon-based quantum technology

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Acceptor-interstitial silicon (A_{Si}-Si_i) defects in silicon affect silicon-based solar cells and low-gain avalanche detectors (LGAD). Additionally, it seems possible that the A_{Si}-Si_i defects have applications in silicon-based quantum technologies e.g. as qubit, as well. [1] Therefore understanding of the basic physical properties of this defect category is crucial. Some of these properties are exemplified and will be discussed in this talk in frame of their impact on silicon solar cells and silicon LGADs. Experimental results as well as theoretical calculations will be presented illuminating the properties of this defect category. [2] On the basis of existing experimental data related to some defects of this category namely In_{Si}-Si_i and Tl_{Si}-Si_i, a usage of these defects as a qubit in silicon-based quantum technology in a similar fashion as the NV center in diamond seems possible. An interpretation of these experimental data will be given. Experimental approaches conducted at CiS to get deeper insight into quantum applicability of this defect category will be discussed. In particular, first optically detected magnetic resonance (ODMR) signals of the In_{Si}-Si_i defect will be presented.

[1] K. Lauer *et al.*, 'Examining the properties of the ASi-Si_i-defects for their potential as qubits', presented at the GADEST but unpublished, Bad Schandau: ResearchGate, May 2024. doi: 10.13140/RG.2.2.18793.51048.

[2] K. Lauer, K. Peh, D. Schulze, T. Ortlepp, E. Runge, and S. Krischok, 'The ASi–Si_i Defect Model of Light-Induced Degradation (LID) in Silicon: A Discussion and Review', physica status solidi (a), vol. 219, no. 19, p. 2200099, 2022, doi: 10.1002/pssa.202200099.