# Siddharth Krishnan

Bridge-Sabarmati Fellow
Materials Science & Engineering (MSE)
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## EDUCATION

**Indian Institute of Technology Gandhinagar (IIT Gandhinagar)** — $Jul\ '16 - Jul\ '20$
B. Tech in EE [ **Minors in Physics** ] — $CPI - 9.19/10.00$

## PRESENTATIONS

**Asymmetric Current-Voltage Characteristics in Graphene-hBN Dot-Ring Nanostructures -a numerical study**
**Siddharth Krishnan**, Ravi Hegde
Presented at *IEEE Nano Materials and Devices Conference (NMDC), October 2020*.

## RESEARCH EXPERIENCES

**IIT Gandhinagar, India** — $Aug\ '20 - Present$
*Bridge-Sabarmati Fellow in MSE*
Advisor: Prof. Raghavan Ranganathan

**Purdue University, West Lafayette** — $May - Jul\ '19$
*Summer Undergraduate Research Fellow at the Network for Computational Nanotechnology*
Advisor: Dr. Tillmann Kubis

**Indian Institute of Technology Madras (IITM)** — $May - Jul\ '18$
*Summer Research Intern*
Advisors: Prof. Anjan Chakravorty

## SUPERVISED RESEARCH PROJECTS

**Development of a High-Fidelity Interatomic Potential for High Entropy Alloy Design** — $Aug'20 - Present$
*Advisor: Prof. Raghavan Ranganathan , IITGN*

We aim to develop an interatomic potential which can be applied to molecular dynamics( MD) to study the properties of High Entropy Alloy systems accurately. The model is based on the Embedded Atom Method and is generated using the Force Field Fitting Algorithm. The fitting data is obtained using first-principle calculations involving ab-initio MD. The model thus generated will be verified with experimental values.

**Cascaded Tunneling Field Effect Transistor(CasTFET)** — $May - Jul\ '19$
*Advisor: Dr. Tillmann Kubis, Network for Computational Nanotechnology, Purdue University*

We performed calculations for Si-Ge heterostructures using a Tight-Binding Hamiltonian based Non-Equilibrium Green's Formalism to study its electronic and transport properties. We optimised the geometry of the device to improve the carrier distribution in the device for a high ON current. We also used the NEGF formalism to study various other prospective material systems for CasTFET, such as InAs-GaSb nanostructures. The calculations were performed on Purdue's HPC clusters.

**Electron Transport in Graphene Nanostructures** $Aug - Dec\,'19$
*Advisor: Prof. Ravi Hegde, IIT Gandhinagar* [Presented at *IEEE NMDC, 2019*]

We studied the peculiar I-V curves and conductance of various Graphene nanostructures, in particular Graphene-hBN heterostructure Ring Dot structure. Tight-binding model was used to study the quantum transport in these structures and highlight their interesting properties. The geometry of the structures were optimized to maximize the current asymmetry in the structures. The physics behind the asymmetry and the effect of gate voltages on the structure was also studied.

**Modeling Thermal Capacitance in Hetero-junction Bipolar Transistors(HBT)** $May - Jul\,'18$
*Advisor: Prof. Anjan Chakravorthy, IITGN*

We conducted a numerical study on heat flow in various high frequency transistor geometries using Technology Computer Aided Design(TCAD) tools and circuit modeling tools. The insights derived from these studies were used to design a *compact model* for transient self heating in Si-Ge HBTs. The models accuracy was tested against TCAD simulation data with success.

**Cost-Effective Integration of Bipolar Transistors in 180nm CMOS Technology** $May - Jul\,'19$
*Advisor: Prof. Nihar Mohapatra, IITGN*

We studied the various aspects of the fabrication process which strongly affect the performance of a BJT using Technology Computer Aided Design software. The geometry and doping of the device was optimized to obtain a gain $\beta$ of 120 and an Early Voltage of 23 V for a bipolar NPN transistor.

## SKILLS

**Script:** Python, C, C++, VerilogA, PBS, SLURM
**Tools:** Quantum Espresso, MATLAB, NEMO5, SILVACO(TCAD), Sentaurus (TCAD), LaTeX

## COURSES

**Undergraduate Level Courses:** Electronic Device, Introduction to Materials Science, Probability and Random Processes
**Graduate Level Courses:** Computational Physics, Quantum Mechanics I, Quantum Mechanics II, Statistical Mechanics, Physics of Transistors, Nanoscale Device Engineering, Lasers, Physics of 2D materials

## TEACHING EXPERIENCE

**Teaching Assistant for EE221(Fall 2019)**
The position involved conducting concept clearing sessions, designing tests and evaluating answer scripts as well as designing problem sets for Electronic Devices course(EE221). It is a course on fundamental semiconductor physics for sophomore Electrical Engineering students.