

Reviewer A

1.) Scientific/scholarly quality (including innovative aspects and originality) with special attention to strengths and weaknesses:

This is an outstanding proposal that definitely merits funding. The proposed insertion and manipulation of Si and P atoms in monolayer graphene is very innovative and transformative. The basic step has already been demonstrated on a single Si atom. The proposal to create artificial Si and P structures and study their plasmonic response is very worthwhile and, if successful, will have major impact on the fields of nanostructures and electron microscopy.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

2.) Approaches/methods and feasibility of the proposal with special attention to strengths and weaknesses:

The proposal is ambitious, but the prospects of success are very high.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

3.) Qualifications of the researchers involved (based on their academic age) with special attention to strengths and weaknesses:

Susi is highly qualified. He is very talented in both microscopy and simulations. This proposal has no identifiable weakness.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

4. Overall evaluation with regard to key strengths and weaknesses:

Outstanding proposal – no weaknesses.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

5. Ethical issues:

Does the project give rise to any ethical issues?

☐ yes ☒ no ☐ do not know

IF YES: Have they been sufficiently addressed or do they need to be addressed more specifically?

Comments:

Reviewer B

1.) Scientific/scholarly quality (including innovative aspects and originality) with special attention to strengths and weaknesses:

The scientific objectives of this proposal are excellent. STEM/EELS measurements will be conducted on few Si and P ion-doped graphene structures in order to study the formation of different defects due to ion bombardment and the resulting collective electron excitations. To support these expected experimental findings, the researchers performed DFT and MD simulation with promising preliminary data. The PI made an analogy of this study to STM manipulation of single atoms, with expectation to image the plasmon resonances at atomic scale resolution with room temperature. The researcher has excellent track records in the proposed topic, and funding of this project would enable new breakthroughs in this emerging area of condensed matter physics.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

2.) Approaches/methods and feasibility of the proposal with special attention to strengths and weaknesses:

The proposed research methods appears to be academically solid and sound. The proposed research plan is well conceived, including comprehensive techniques ranging from DFT and MD models for ion implantation, sample preparation processes (such as control of ion energy), to atomic resolution STEM/EELS characterization. The proposal overcomes several current challenges of doping and formation heterostructures on 2D materials, with promise to advance our understanding of optical excitation and charge transfer in these novel materials with very fine spatial resolution.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

3.) Qualifications of the researchers involved (based on their academic age) with special attention to strengths and weaknesses:

The proposer has excellent track records in terms of scientific publication and collaborative network in surface science of carbon nanotubes and related heterostructures by doping. The proposer also has a balanced research experience/skills both in theoretical and experimental aspects of the project. Optoelectronics and plasmonics of graphene is a relatively new research topic for the researcher but the reviewer believes the PI will likely make significant contributions to this emerging area.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

4. Overall evaluation with regard to key strengths and weaknesses:

Overall this is an excellent proposal with great potential to success. The PI is well qualified with excellent track record and access to the state-of the art TEM/EELS facilities to conduct the proposed experimental studies. The proposed ideas are original and could have direct impact on advancing knowledge and application of Si or P doped graphene heterostructures in optoelectronics. I would also encourage the PIs to attend international conferences on nanophotonics, such as APS meetings or EOS meetings, and disseminate their findings to the community.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> very good	<input type="checkbox"/> good	<input type="checkbox"/> average	<input type="checkbox"/> poor
---	------------------------------------	-------------------------------	----------------------------------	-------------------------------

5. Ethical issues:

Does the project give rise to any ethical issues?

☐ yes ☐ no ☒ do not know

IF YES: Have they been sufficiently addressed or do they need to be addressed more specifically?

Comments: