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Ghiasi, Talieh

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Propositions

accompanying the dissertation

Proximity-induced spin-orbit and exchange coupling in graphene-based heterostructures

1. Nobody can outperform a team of appropriately selected individuals. This is readily confirmed by van der Waals heterostructures where graphene is teamed up with other 2D materials and its superior charge and spin transport properties get enriched with the induced spin-orbit and exchange coupling.

2. To make high quality electrical contacts with 2D materials, use 2D materials. A bilayer of insulating hBN appears to be an excellent choice as an ultra-thin, flat and pin-hole-free tunnel barrier for charge and spin injection into 2D materials. [chapter 5 and 6]

3. The strong anisotropy of spin dynamics in graphene-TMD hybrids introduces another control knob for graphene-based spin-logic operations, as they act like spin-filters where the transmission depends on the orientation of the spins. [chapter 6]

4. The experimental realizations of the spin-polarized conductivity together with the spin Hall, Rashba-Edelstein, anomalous Hall and spin-dependent Seebeck effects all assure strong spin-charge coupling in proximitized graphene. These observations open the path for direct application of electrically-controlled graphene-based spintronic and spin-caloritronic circuitries. [chapter 7 and 8]

5. Two-dimensional materials are perfectly flat, mechanically strong and easy to handle, until you actually have to work with them! Yet the fascinating physics they offer makes dealing with them worth the effort.

6. The current pace of research and the rising competition bring up the dilemma of whether to submit your results with unanswered open questions or to delay in order to fill the remaining gaps. Thus, being able to figure out when to draw a line in collecting/analyzing data becomes a vital research skill.

7. Complaining has become a hard-wired mental attitude nowadays. Only the topic changes across the borders, based on the standards of societies.

8. Those with authority in a group should not underestimate the unconscious impact of their attitude on the group spirit.

9. One cannot justify an action as positive by simply labeling it as positive. "Positive bias" for gender equalization is an example of that. The act of favoring women in academia encourages gender-biased mentality, whereas all should be offered equal opportunities regardless of their gender. Gender-neutral thinking must be reinforced from early education to have it as a deep-seated mindset.

10. The slavery of h-index is a dark side of academia today. Academic judgement based on "numbers" as the indicator of research quality or scientific success needs to be moderated. The criteria for evaluating candidates should be revised by giving more priority to the depth of knowledge and true scientific contributions, problem-solving and communication skills, flexibility and teamwork.

Talieh Ghiasi