Can Brownian motion and photon carrier multiplication create an efficient power converter background research

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Background

Brownian motion was discovered by Robert Brown in 1827, when he discovered the seemingly random movements of pollen in water. This motion was shown to follow 7 main points after careful experimentation, of which a summary that particles move in random, varying, and never-ending ways when suspended in a liquid, can be drawn (Nelson, E., 1966). This motion was hypothesized that it could be a potential source of harnessing energy over the years. Researchers found that not only was Brownian motion apparent in graphene, but also that the motion could be used as a source of energy, needing only room temperature heat to run (Ackerman, M. L., Kumar, P., Neek-Amal, M., Thibado, P. M., Peeters, F. M., & Singh, S., 2016). These experimenters were able to show inversions in the graphene taking place using microscopy imaging, and when placed between two electrodes the inversions taking place conduct electricity by touching the electrodes. A frame of 10 microns was shown to produce a power of 10 picowatts with exponential growth of power along with size (Ackerman, M. L. et al., 2016), although the researchers did not explicitly how large the exponential growth was, and none of the results reflected that growth.

Another property graphene has found to reflect is the multiplication of a photon’s energy through a chain-effect electron excitation process (Johannsen, J. C., Ulstrup, S., Crepaldi, A., Cilento, F., Zacchigna, M., Miwa, J. A., … Hofmann, P., 2014). This process allows the energy of a photon to be effectively multiplies with the power of an external heating. Researchers in this experiment heated the object to 300K, roughly 80°F so slightly more than room temperature, in a vacuum chamber and tested the efficiency of the excitation process by utilizing a measurement of the carrier multiplication factor, or CM (Johannsen, J. C. et al., 2016). The experimenters used a model of a carbon-rich layer for n-doped graphene, and a hydrogen rich layer for p-doped, which by a few calculations effectively means the n-doped is “more doped” than the p-doped per say (Johannsen, J. C. et al., 2016). This research is currently looked at for a way to produce much more efficient solar panel cells, as the energy transfer for the n-doped graphene was very high, and 3 times higher than the p-doped making n-doped the more realistic choice. Models of the n-doped and p-doped graphene were not elaborated past the context of the doping layer explanation, although examples of models of n-doped (Usachov, D., Vilkov, O., Grüneis, A., Haberer, D., Fedorov, A., Adamchuk, V. K., … Vyalikh, D. V., 2011) and p-doped graphene (D’Arsié, L., Esconjauregui, S., Weatherup, R. S., Wu, X., Arter, W. E., Sugime, H., … Robertson, J., 2016) were found.

I plan to combine these processes to make the overall energy conversion processes more efficient. Both the stochastic (Brownian) motion and the CM factors of graphene are not completely reliable, as the energy transfers occurring are based on chance and random probability, as usual with particles. If combined in one generator, these processes could help counteract the unreliability of each of these processes to make the generation more efficient. The stochastic motion would be able to run for the most part on its own, however the CM factor would require a light source to supply photons, so either a self-sustained light source or an external one would be required, although a making a source self-sustained may lose a large amount of efficiency. However, currently I don’t plan on simply combining the two processes, but to discover the most efficient layout for a small space, collecting data on different variables such as the area of the graphene layer (mainly pertaining to the stochastic motion) and the number of graphene layers and their position around the light source (pertaining to the CM property). This angle could reveal more about the efficiency behind the energy conversions by these processes, and possibly be used to further the current Brownian motion graphene generator design’s capabilities, or as a further understanding of combining graphene properties to achieve higher levels of efficiency and more capabilities.

References

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