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Photoconductivity in thin films of $MAPbI_3$, $MAPbI_2Br$ and $MAPbI_2Cl$ Perovskites

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Hybrid organic/inorganic perovskite materials (e.g., $CH_3NH_3PbI_3$) as light absorbers are currently among the most promising candidates for thin-film photovoltaic (PV) applications. Great advances in terms of efficiency have been achieved with this type of devices, however there are many doubts about their properties and the relationship of these with the efficiency of the devices. In this work, thin films of $MAPbI_3$, $MAPbI_2Br$ and $MAPbI_2Cl$ were evaluated through photoconductivity measurements, which allowed to determine the activation energy corresponding to the levels associated to the trap centers present in the samples studied. Through fitting of decay curves of photocurrent simulated theoretically to the one obtained experimentally, it was possible to determine the values of the time constants (ti) corresponding to each kind of trap centers. The activation energy associated to these traps was estimated from an Arhenius type fitting of the ti values obtained at different temperatures in the range between room temperature and 100°C. It was found evidence for the presence of three types of traps in the studied perovskite films ($MAPbI_2Cl$, $MAPbI_2Br$ and $MAPbI_3$), which differ both in depth and in the values of the corresponding time constants.

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Bosonization, stimulated emission and clustering of fermions

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The presently known and potential future manifestations of bosonization of fermions will be discussed. The conditions for such bosonization will be detailed in the context of actual physical interactions in addition to its Mathematical Physics foundations. The roles of spontaneous and stimulated emission processes for the self-generation and growth of quantized collective elementary excitations will be explained in the context of the above form of bosonization in Many Body Theory. The possibility that such bosonization can lead to the clustering of fermions and thereby to the precipitation of the associated condensate will be probed. The generality of this process will be gleaned from a detailed discussion of a set of specific examples giving us clues as to how to resolve technical issues related to its treatment in Theoretical Physics and to its present and future practical technological applications.

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