Photoluminescence and Photocurrent of Thin Semiconducting Transition Metal Dichalcogenides

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The interest in electronic and optical properties of Transition Metal Dichalcogenides (TMD) is rising since the exfoliation and the preparation of a MoS_2 single layer field-effect transistor[1]. It was also shown before that these family of compounds, in their bulk state an indirect bandgap semiconductor, undergo a transition to a direct bandgap semiconductor when thinned down to one flake[2].
In this work we present recent photoluminescence and photoconductivity measurements of exfoliated MoS_2, $MoSe_2$ and WS_2. The obtained flakes were contacted electrically through standard electron-beam lithography procedures. Through the top and/or back gate we probe the response of these systems as a function of an external electric field and doping. We thus study different effects in this compounds, e.g. the valley polarisation[3, 4] or the ambipolar transport[5], which make TMD a promising candidate for new nanotechnological applications.

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