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Nature of Electronic States in Ultrathin MoS_2 Field Effect Transistor SUBHAMOY GHATAK, ATINDRA NATH PAL, ARINDAM GHOSH, Indian Institute of Science, Bangalore, LOW TEMPERATURE NANOELECTRONICS GROUP TEAM — Molybdenum disulphide (MoS_2) is a layered transition metal dichalcogenide with a Mo layer sandwiched between two S layers (S-Mo-S), which forms its basic unit. Each basic unit is attached to other units only with weak Van der Waals force. This enables to make an atomically thin single layer of MoS_2 with a bandgap 1.9 eV. The presence of bandgap has made it an interesting material in thin film transistors. It has been reported [1] recently that very high on/off ratio ($\sim 10^8$) can be obtained in single layer MoS_2 transistor due to the presence of this bandgap. Though the on/off ration is very high, mobility in these transistors are considerably low. Here we have investigated the origin of such low mobility. From our temperature dependent study we find that atomically thin MoS_2 layer becomes highly disordered in the presence of the substrate and electron got localised in the traps created by the charge impurities at substrate-MoS_2 interface. We propose that high mobility can be obtained in these transistors by removing the charge impurity background.

[1] Radisavljevic, B. *et al.* Nature Nanotechnology **2011**, 6, 147–150.
[2] Ghatak, S. *et al.* ACS Nano **2011**, 5, 7707.

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