## Abstract Submitted for the MAR17 Meeting of The American Physical Society

Visualization of defect-induced excitonic properties of the edges and grain boundaries in synthesized monolayer molybdenum disulfide<sup>1</sup> AKM NEWAZ, A.E. YORE, A. MILLER, W. CRUMRINE, B. REDD, J.A. TUCK, San Francisco State University, BIN WANG, University of Oklahoma, K.K.H SMITHE, E. POP, Stanford University — Understanding nanoscale optical behavior of the edges and grain boundaries of synthetically grown transition metal dichalcogenides (TMDCs) is vital for optimizing their optoelectronic properties. Here we present our experimental work on spatial photoluminescence (PL) scanning of large size ( $\geq 50\mu$ m) monolayer MoS<sub>2</sub> grown by chemical vapor deposition (CVD) using a diffraction limited blue laser beam spot (wavelength 405 nm) with a beam diameter as small as  $\sim 200$  nm allowing us to probe nanoscale excitonic phenomena which was not observed before. We have found several important features: (i) there exists a sub-micron width strip ( $\sim 500 \text{ nm}$ ) along the edges that fluoresces  $\sim 1000\%$  brighter than the region far inside; (ii) there is another brighter wide region consisting of parallel fluorescing lines ending at the corners of the zigzag peripheral edges; (iii) there is a giant blue shifted A-excitonic peak, as large as  $\sim 120$  meV, in the PL spectra from the edges. Using density functional theory calculations, we attribute this giant blue shift to the adsorption of oxygen dimers at the edges, which reduces the excitonic binding energy. Our results offer an attractive route to tailor optical properties at the TMDC edges through defect engineering.

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> Akm Newaz San Francisco State University

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