Bi-2212/TaS$_2$ Van der Waals Junctions: Interplay of proximity induced high-$T_c$ Superconductivity and CDW order$^1$ ANG LI, XIAOCHEN ZHU, GREGORY STEWART, ARTHUR HEBARD, Univ of Florida - Gainesville, ARTHUR F. HEBARD TEAM, GREGORY R. STEWART COLLABORATION — We present an experimental observation of high-$T_c$ superconducting proximity effect by using four-terminal current-voltage measurements to study the Van der Waals interface between freshly exfoliated flakes of the high-$T_c$ superconductor, Bi-2212, and the CDW-dominated TMD layered material, 1T-TaS$_2$. For highly transparent barriers, there is a pronounced Andreev reflection feature providing evidence for proximity-induced high-$T_c$ superconductivity in 1T-TaS$_2$ with a surprisingly large energy gap ($\sim 20\text{meV}$) equal to half that of intrinsic Bi-2212 ($\sim 40\text{meV}$). Our systematic study using conductance spectroscopy $dI/dV$ of junctions with different transparencies also reveals the presence of two separate boson modes, each associated with a “dip-hump” structure. We infer that the proximity-induced high-$T_c$ superconductivity in the TaS$_2$ is driven by coupling to the metastable metallic phase coexisting within the Mott-CCDW (commensurate CDW) phase.

$^1$Work supported by NSF DMR #1305783

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Date submitted: 07 Nov 2016