In Situ Thin Film Growth and Characterization of Topological Dirac Semimetal Na$_3$Bi$^1$ JACK HELLERSTEDT, MARK EDMONDS, CHANG LIU, Monash Centre for Atomically Thin Materials, NAVNEETH RAMAKRISHNAN, NUS Singapore, SHAFFIQUE ADAM, Yale-NUS College, MICHAEL FUHRER, Monash Centre for Atomically Thin Materials — The alkali pnictide Na$_3$Bi is a three-dimensional Dirac semimetal possessing Dirac-like dispersions in $k_x$, $k_y$ and $k_z$, that has attracted recent interest as a condensed matter system for realizing the chiral anomaly [1]. The high reactivity of sodium makes conventional synthesis and characterization extremely difficult: we circumvent this issue by combining thin film growth with low temperature STM and magnetotransport in one comprehensive UHV system. We have successfully grown Na$_3$Bi on α-Al$_2$O$_3$ (0001) substrates, achieving low temperature mobilities in excess of 3,500 cm$^2$/Vs and carrier densities as low as $5 \times 10^{12}$ cm$^{-2}$. Perpendicular magnetoresistance up to 1T shows quadratic behavior with weak anti-localization at low field. Quantitative analysis of this data suggests that our samples are in a charge inhomogeneous regime reminiscent of charge puddling in graphene [2]. [1] Xiong et. al Science (2015) doi:10.1126/science.aac6089 [2] Ramakrishnan et. al arXiv:1501.03815 (2015)

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