Multi-orbits observed in superconducting Nb-doped Bi$_2$Se$_3$ BENJAMIN LAWSON, PAUL CORBAE, GANG LI, FAN YU, TOMOYA ASABA, COLIN TINSMAN, Univ of Michigan - Ann Arbor, YUNSHENG QIU, YE W SAN HORIZ, Missouri University of Science and Technology, LU LI, Univ of Michigan - Ann Arbor — Recently discovered superconducting niobium doped Bi$_2$Se$_3$ shows promise to realize new physical phenomenon including the coexistence of superconductivity and magnetic ordering and possibly topological superconductivity. To understand the new physics showcased in this system, a detailed knowledge of the electronic structure is needed. We present the first observation of quantum oscillations in the magnetization (the de Haas-van Alphen effect) of Nb-doped Bi$_2$Se$_3$. In the fully superconducting crystal, two distinct orbits are observed, in sharp contrast to Bi$_2$Se$_3$, Cu-doped Bi$_2$Se$_3$, and Sr-doped Bi$_2$Se$_3$. The multiple frequencies observed in our quantum oscillations, combined with our electrical transport studies, indicate the multi-orbit nature of the electronic state of Nb-doped Bi$_2$Se$_3$. 

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