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Feshbach shape resonance in a superlattice of superconducting layers: the case of aluminum doped magnesium diboride[1] A. BIANCONI, M. FILIPPI, M. FRATINI, V. PALMISANO, L. SIMONELLI, N. L. SAINI, Dept. of Physics, University of Rome "La Sapienza" P.le. A. Moro 2, 00185 Roma, Italy, E. LIAROKAPIS, Department of Applied Mathematics and Physics, National Technical University of Athens, GR-157 80 Athens, Greece — We have synthesized highly pure cristalline magnesium diboride samples where Mg is substituted by Al. We show that by electron doping magnesium diboride it is possible to tune the chemical potential to the Feshbach shape resonance in a superlattice of metallic layers. In this multiband superconductor in the clean limit, showing two gap superconductivity, the interband exchange like pairing term shows a Feshbach shape resonance in the proximity of the 2D to 3D Lifshitz electronic topological transition (2D/3D ETT). This is shown that the Feshbach resonance is the key term controlling the increase of the critical temperature in the low temperature range to 40K. The variation of the electron phonon interaction is probed by micro-Raman. The 2D/3D ETT is shown by micro Raman and a lattice anomaly. The control of the nanoscale phase separation tuning the chemical potential in the proximity of the ETT is discussed. The Feshbach resonance inthe interband pairing is indicated by the suppression of the isotope coefficient in the critical temperature as a function of aluminum substitution.

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