Prediction of a Spin-Polarized Two-Dimensional Electron Gas 
at the LaAlO3/EuO(001) Interface

YONG WANG, MANISH NIRANJAN, 
JOHN BURTON, JOONHEE AN, KIRILL BELASHCHENKO, EVGENY TSYM-
BAL, Department of Physics and Astronomy, University of Nebraska-Lincoln — The 
discovery of a two-dimensional electron gas (2DEG) at the interface between insu-
lating oxides like LaAlO3/SrTiO3 is promising in designing novel electronic devices. 
Making a spin-polarized 2DEG is a very exciting prospect for spintronics applica-
tions, where the involvement of the spin degree of freedom broadens the spectrum 
of potential applications. Here we propose a method to achieve a spin- polarized 
2DEG by employing a ferromagnetic insulator as one of the constituents in the ox-
ide heterostructure and consider EuO as a representative ferromagnetic insulator in 
conjunction with LaAlO3 to form a spin-polarized 2DEG at the LaAlO3/EuO (001) 
interface.[1] This polar interface favors electron doping into the Eu-5d conduction 
bands. Due to the exchange splitting of the Eu-5d states in the ferromagnetic insula-
tor the 2DEG is spin-polarized below the Curie temperature of EuO. Spin-polarized 
properties of this 2DEG at the interface between polar and ferromagnetic insulators 
inherited from the ferromagnetism of the oxide may provide a robust magnetism 
of the 2DEG which is beneficial and interesting for spintronics applications. [1] Y. 

Yong Wang
Department of Physics and Astronomy, University of Nebraska-Lincoln

Date submitted: 19 Nov 2009
Electronic form version 1.4