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OBSERVATION OF RASHBA TYPE SPIN SPLITTING IN GE-DOPED PBSE FERROELECTRIC SEMICONDUCTOR

T. Zakusylo,[1,*] G. Krizman,[1] M. Hajlaoui,[1] T. Takashiro,[1] L. Sajeev,[2] M. Rosmus,[3] N. Olszowska,[3] O. Caha,[2] and G. Springholz[1]

[1]*Institute of Semiconductor and Solid State Physics, Johannes Kepler University, 4040, Linz, Austria*

[2]*Department of Condensed Matter Physics, Masaryk University, 611 37, Brno, Czech Republic*

[3]*National Synchrotron Radiation Centre SOLARIS, Jagiellonian University, 30-392 Krakow, Poland*

*E-mail: tetiana.zakusylo@jku.at

Ferroelectric Rashba semiconductors exhibiting a giant Rashba type spin splitting of ferroelectric origin are a new class of multifunctional materials promising for spintronics yet still lacking experimental realization. In the present work, the ferroelectric Rashba effect is demonstrated for the first time in Germanium-doped PbSe quantum wells by means of temperature-dependent angle resolved photoemission spectroscopy (ARPES) spanning over the whole temperature range of the ferroelectric phase transition from room temperature down to 10 K, with particular attention to the Rashba splitting at the band edges at the high symmetry Γ and M points. The results (Fig.1) unveil a temperature-dependent Rashba type spin splitting that diminishes gradually as the system undergoes a phase transition from ferroelectric to paraelectric phase. Above the ferroelectric transition temperature T_C, sharp nondegenerate bands are observed, which indicates the absence of any surface-induced Rashba effect. Thus, the temperature-dependent lifting of the Kramer's spin degeneracy below the T_C is clearly of the ferroelectric origin. This demonstrates Ge-doped PbSe as a promising new compound for ferroelectric Rashba semiconductor applications.

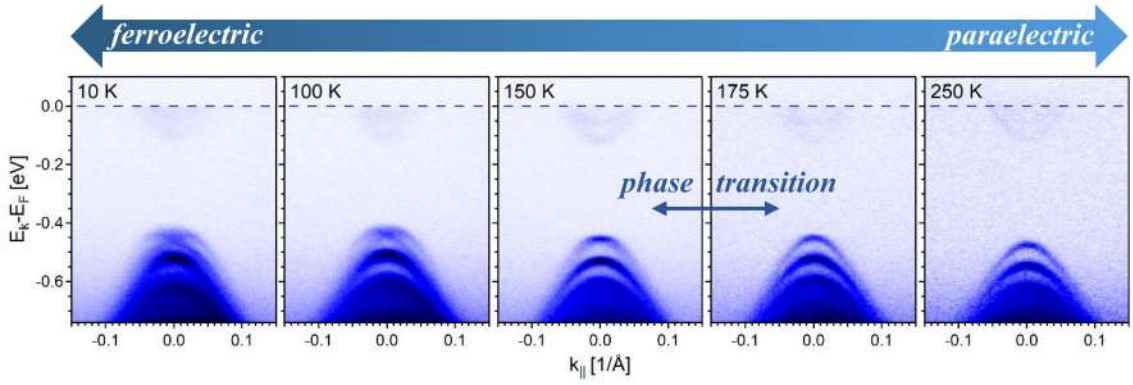

Figure 1. Temperature-dependent Rashba type spin splitting in $Pb_{1-x}Ge_xSe$ quantum wells caused by the ferroelectric phase transition occurring at a critical T_C ~170 K for x_{Ge} = 8% in this case. ARPES maps were recorded along the M−K direction from 10 K to 250 K at a photon energy hν = 18 eV at the URANOS beamline of SOLARIS.