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Exciton condensation and quantum spin Hall effect in InAs/GaSb bilayers DMITRY PIKULIN, TIMO HYART, Instituut-Lorentz, Universiteit Leiden, P.O. Box 9506, 2300 RA Leiden, The Netherlands — We study the phase diagram of the inverted InAs/GaSb bilayer quantum wells as a function of tunneling between the layers and spin-orbit coupling. For small tunneling amplitude between the layers, we find that the system is prone to formation of an s-wave exciton condensate topologically trivial phase. On the contrary, for large tunneling amplitude, we obtain a topologically non-trivial quantum spin Hall insulator phase with a p-wave exciton order parameter, which enhances the hybridization gap and supports edge transport. These topologically distinct insulators are separated by an insulating phase with spontaneously broken time-reversal symmetry. Close to the phase transition between the quantum spin Hall and time-reversal broken phases, the edge transport shows quantized conductance in small samples, whereas in long samples the mean free path associated with the backscattering at the edge is temperature independent, in agreement with recent experiments.

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