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7 Fermi-liquid behavior in an underdoped high-Tc superconductor	Sebastian, S.E., Harrison, N., Abrahams, M.M., Liang, R., Bonn, D.A., Hwang, W.T., Loncharuk, G.C.	2010	Physical Review B - Condensed Matter and Materials Physics 81(14) art. no. 140502	5

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### The quantum spin Hall effect and topological insulators

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\* Stanford University, Stanford, CA, United States

**Abstract**

In the quantum world, atoms and their electrons can form many different states of matter, such as crystalline solids, magnets, and **superconductors**. These different states can be classified by the **symmetries** they spontaneously break: translational, rotational, and gauge **symmetries**, respectively, for the examples above. Before 1980 all states of matter in condensed-matter systems could be classified by the principle of **broken symmetries**. The quantum Hall (QH) state, discovered in 1980, provided the first example of a quantum state that has no spontaneous **broken symmetry**: its behavior depends only on its topology and not on its specific geometry; it was topologically distinct from all previously known states of matter. © 2010 American Institute of Physics.

**Language of original document**  
English

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- 1 Kitting, K.V., Dorda, G., Pepper, M.  
New method for high-accuracy determination of the fine-structure constant based on quantized hall resistance (1980) Physical Review Letters 45(8) pp. 484-487. Citad 1044 times.  
doi: 10.1103/PhysRevLett.45.494
- 2 Bernevig, B.A., Hughes, T.L., Zhang, S.-C.  
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3	The effective fine-structure constant of freestanding graphene measured in graphite	Reed, J. P., Uchida, S., Jia, Y., Gan, Y., Csisz, D., Fradkin, E., Aboumouf, F.	2010	Science 320 (6055), pp. 805-809	6
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5	Universal behavior of entanglement in 2D quantum critical diener models	Hou, B., Fradkin, E.	2010	Journal of Statistical Mechanics: Theory and Experiment 2010 (9), art. no. P09004	0
6	Pair-density wave correlations in the Kondo-Nelsoberg model	Berg, E., Fradkin, E., Kivelson, S. A.	2010	Physical Review Letters 105 (14), art. no. 148402	1
7	Tunable gas sensing properties of p- and n-doped ZnO thin films	Kobinsky, V., Fradkin, E., Lumelitsy, V., Rothschild, A., Komen, T., Litnits, I.	2010	Sensors and Actuators: B: Chemical 148 (2), pp. 379-387	1

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