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**Teoretyczna analiza układów silnie skorelowanych  
fermionów w oparciu o grupy symetrii  $U(1)$  i  $SU(2)$**

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We implement the rotationally-invariant formulation of the two-dimensional Hubbard model, with nearestneighbors hopping  $t$ , which allows for the analytic study of the system in the low-energy limit. Both  $U(1)$  and  $SU(2)$  gauge transformation are used to factorize the charge and spin contribution to the original electron operator in terms of the corresponding gauge fields. The Hubbard Coulomb energy  $U$ -term is then expressed in terms of quantum phase variables conjugate to the local charge and variable spin quantization axis, providing a useful representation of strongly correlated systems. It is shown that these gauge fields play a similar role as phonons in the BCS theory: they act as the *glue* for fermion pairing.