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Reprints

General Formulation

 Derivation of the Brueckner Many-Body Theory, by J. Goldstone Proc. Roy. Soc. (London), A239, 267-279 (1957) 	109
The Description of Collective Motions in Terms of Many-Body Perturbation Theory, by J. Hubbard ● Proc. Roy. Soc. (London), A240, 539-560 (1957)	122
Application of Quantum Field Theory Methods to the Many Body Problem, by V. Galitskii and A. Migdal ● Soviet Physics JETP, 7, 96-104 (1958)	144
Electron Gas	
A Collective Description of Electron Interactions: III. Coulomb Interactions in a Degenerate Electron Gas, by D. Bohm and D. Pines ● Phys. Rev., 92, 609-625 (1953)	153
A Collective Description of Electron Interactions: IV. Electron Interaction in Metals, by D. Pines • Phys. Rev., 92, 626-636 (1953)	170
Correlation Energy of an Electron Gas at High Density, by M. Gell-Mann and K. Brueckner ● Phys. Rev., 106, 364-368 (1957)	181
Specific Heat of a Degenerate Electron Gas at High Density, by M. Gell-Mann ● Phys. Rev., 106, 369-372 (1957)	186
Correlation Energy of an Electron Gas at High Density: Plasma Oscillations, by K. Sawada, K. Brueckner, N. Fukuda, and R. Brout ● Phys. Rev., 108, 507-514 (1957)	190

Correlation Energy of a High-Density Gas: Plasma Coordinates, by R. Brout • Phys. Rev., 108, 515-517 (1957)	198
Diamagnetism of a Dense Electron Gas, by G. Wentzel ● Phys. Rev., 108, 1593-1596 (1957)	201
The Description of Collective Motions in Terms of Many-Body Perturbation Theory: II. The Correlation Energy of a Free-Electron Gas, by J. Hubbard ● Proc. Roy. Soc. (London), A243, 336-352 (1957)	205
Correlation Energy of a Free Electron Gas, by P. Nozières and D. Pines • Phys. Rev., 111, 442-454 (1958)	222
A Dielectric Formulation of the Many Body Problem: Application to the Free Electron Gas, by P. Nozières and D. Pines ● Il Nuovo Cimento, [X]9, 470-489 (1958)	235
Self-Consistent Field Approach to the Many-Electron Problem, by H. Ehrenreich and M. Cohen ● Phys. Rev., 115, 786- 790 (1959)	255
Interacting Fermion System The Theory of a Fermi Liquid, by L. Landau ● Soviet Physics JETP, 3, 920=925 (1957)	260
Oscillations in a Fermi Liquid, by L. Landau ● Soviet Physics JETP, 5, 101-108 (1957)	266
On the Theory of the Fermi Liquid, by L. Landau ● Soviet Physics JETP, 8, 70-74 (1959)	274
The Energy Spectrum of a Non-Ideal Fermi Gas, by V. Galitskii • Soviet Physics JETP, 7, 104-112 (1958)	279
Collective Excitations of Fermi Gases, by J. Goldstone and K. Gottfried • Il Nuovo Cimento, [X]13, 849-852 (1959)	288
Interacting Boson Systems On the Theory of Superfluidity, by N. Bogoljubov ● J. Phys. USSR, 11, 23-32 (1947)	292
Eigenvalues and Eigenfunctions of a Bose System of Hard Spheres and Its Low-Temperature Properties, by T. Lee, K. Huang, and C. Yang ● Phys. Rev., 106 , 1135-1145 (1957)	302
Application of the Methods of Quantum Field Theory to a System of Bosons, by S. Beliaev • Soviet Physics JETP, 7, 289- 299 (1958)	313

Energy Spectrum of a Non-Ideal Bose Gas, by S. Beliaev • Soviet Physics JETP, 7, 299-307 (1958)	323
Ground-State Energy and Excitation Spectrum of a System of Interacting Bosons, by N. Hugenholtz and D. Pines ● Phys. Rev., 116, 489-506 (1959)	332
Electron-Phonon Interaction Electron-Phonon Interaction in Metals, by J. Bardeen and D. Pines • Phys. Rev., 99, 1140-1150 (1955)	350
Interaction between Electrons and Lattice Vibrations in a Normal Metal, by A. Migdal • Soviet Physics JETP, 7, 996-1001 (1958)	361
Superconductivity Bound Electron Pairs in a Degenerate Fermi Gas, by L. Cooper ● Phys. Rev., 104, 1189-1190 (1956)	367
Theory of Superconductivity, by J. Bardeen, L. Cooper, and J. Schrieffer • Phys. Rev., 108, 1175-1204 (1957)	369
A New Method in the Theory of Superconductivity: I, by N. Bogoljubov ● Soviet Physics JETP, 7, 41-46 (1958)	399
Comments on the Theory of Superconductivity, by J. Valatin • Il Nuovo Cimento, [X]7, 843-857 (1958)	405
On the Energy Spectrum of Superconductors, by L. Gorkov • Soviet Physics JETP, 7, 505-508 (1958)	420
Random-Phase Approximation in the Theory of Superconduc- tivity, by P. Anderson ● Phys. Rev., 112 , 1900-1916 (1958)	424
Collective Excitations in the Theory of Superconductivity, by G. Rickayzen ● Phys. Rev., 115, 795-808 (1959)	441
Ground-State Energy and Green's Function for Reduced Hamiltonian for Superconductivity, by J. Bardeen and G. Rickayzen • Phys. Rev., 118, 936-937 (1960)	

Comments and Corrections

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