CURRICULUM VITAE

PERSONAL DATA:

Name: Alexander N. Omelyanchouk
Date of birth:28 July, 1947
Place of birth: Budapest, Hungary
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EDUCATION:

1990 Received the DSc Degree in Solid State Physics from Institute for Low Temperature Physics and Engineering of the Ukrainian SSR Academy of Sciences. DSc Degree Thesis: "Theory of kinetic phenomena in metal microstructures".

1978 Received the PhD in Solid State Physics from Institute for Low Temperature Physics and Engineering of the Ukrainian SSR Academy of Sciences. PhD Thesis: "Theory of weak superconducting links and point-contact spectroscopy of metals" (scientific supervisor: Professor Igor.O.Kulik).

1970 Graduated cum laude from the Physical Department of Kharkov State University. Majored in physics theory, with emphasis on theory of condensed matter.

1970 Master's Thesis "On the theory of phase transitions in magnetics" defended at the Kharkov State University (scientific supervisor: Professor MoiseyI.Kaganov).

1965Graduated from the high school in Kharkov.

CAREER POSITIONS:

Since 2016 Chief Resercher of department "Superconducting and Mesoscopic Structures and Devices"

Since 2013 Professor зі спеціальності 01.04.07 – фізика твердого тіла

Since 2006 Member-correspondent of National Academy of Sciences of Ukraine

Since 2000 Head of department "Superconducting and Mesoscopic Structures and Devices"

1990 Leading Reserch Associate of Theoretical Department

1981 Senior Research Associate of Theoretical Department

1973 Research Associate of Theoretical Department.

Since 1972 On the research staff of the Institute for Low Temperature Physics and Engineering of the Ukrainian Academy of Sciences.

RESEARCH FIELDS:

Theory of nonlinear electron transport in metals and superconductors. Physics of microcontact phenomena.

Point contact spectroscopy of electron-phonon interaction in metals. Nonequilibrium phenomena in point contacts.

Josephson effect in point contacts and microbridges. Macroscopic quantum phenomena in weakly coupled superconductors with applications to SQUID's.

Josephson qubits for quantum computers.

Theory of weakly coupled multiband superconductors.

SCIENTIFIC DISTINCTIONS:

Received diploma of Doctor of Science (Dr.Sci.) in Physics and Mathematics conferred by the Higher Attestation Committee of the USSR in June 1, 1990.

Received diploma of Candidate of Sciences (PhD) in Physics and Mathematics conferred by the Higher Attestation Committee of the USSR in March 15, 1978.

Received an award and a certificate No.328 for the Discovery of point contact spectroscopy in metals conferred by State Committee for discoveries of the USSR in December 26, 1988 for "The phenomenon of the energy redistribution by charge carriers in metallic point contacts at low temperatures". Authors: Yu.V.Sharvin, I.K.Yanson, I.O.Kulik, A.N.Omelyanchouk, R.I.Shekhter.

IMPORTANT SCIENTIFIC ACHIEVEMENTS:

Theory of high-temperature superconductivity. In the frame of the theory of high-Tc superconductivity based on the model of local pairing the current carrying states is studied and the value and temperature dependence of the critical current was obtained.

Theory of strong electron-phonon interaction effects for non-phonon mechanism of superconductivity is investigated.

Point-contact spectroscopy of electron-phonon interaction in metals. Nonequilibrium phenomena in point contacts.

Theory of ballistic charge transport in point contacts between normal metals is developed. Nonlinear current-voltage characteristic is shown to be directly related to the electron- phonon interaction function of a metal . This is a basis for a new branch of solid state spectroscopy, a point contact spectroscopy of metals.

Specific ballistic transport phenomena in point contacts are predicted including significant reduction of shot noise, drastic change in phonon-drag thermopower, specific frequency dependence of contact conductivity and kinetic inductunce due to electron-phonon renormalisation effects.

Ballistic thermoelectric phenomena including phonon-drag thermopower quenching in the limit of contact diameter smaller than the phonon-electron mean free path.

Theory of the point-contact spectroscopy of superconductors. Theory of the nonlinear current-voltage characteristics of the point contacts in superconducting state is developed. This theory includes the effects of strong electron-phonon interaction and provides the new branch of PC spectroscopy - the elastic contact spectroscopy of electron- phonon interaction in superconductors.

Josephson effect in conventional and unconventional superconducting weak links

Microscopic theory of the Josephson effect in superconducting point contacts (weak links) is developed predicting specific temperature dependence of current and non simple-sinusoidal current-phase relation. Coexistence of Josephson current and thermoelectric phenomena in ballistic superconducting point contacts is studied and the current-phase relation and the critical current have been found.

Bernoulli effect in superconductors is studied, with emphasizing on specific features in the case of High-Tc superconductors. Caused by Bernoulli effect, the electric polarization of superconductors in the static magnetic field was predicted.

The theory of new kind of Josephson microstructures — multiterminal weak links is developed. The multiterminal SQUID controlled by the transport current is proposed and studied.

The theory of spontaneous current states in Josephson junctions of d-wave superconductors is developed.

Theory of mesoscopic ballistic multiterminal microstructures

The specific features of the ballistic Josephson multiterminals, based on the coupling through the two-dimensional electron gas, are studied. Effect of magnetic flux transfer is predicted. The 4-terminal mesoscopic Josephson qubit is proposed and studied.

Josephson effect in weak links based on multiband superconductors is developed. The new kind of multiband SQUID is proposed and stydied.

SELECTED PUBLICATIONS:

1. Quantum coherence phenomena in Josephson qubits, A.N.Omelyanchouk, E Il'ichev, and S.N. Shevchenko, Publishing "Naukovadumka" of NAS of Ukraine, Kiev (2013).
2. Consistency of ground state and spectroscopic measurements on flux qubits, A.Izmalkov, S.H.W.VanDerPloeg, S.Shevchenko, M.Grajcar, E Il'ichev, U.Hübner, A.Omelyanchouk, H.-G.Meye, Physicalreviewletters 101 (1), 017003, (2008).
3. Multiphoton transitions between energy levels in a phase-biased Cooper-pair box, V.Shnyrkov, Th.Wagner, D.Born, S.Shevchenko, W.Krech, A.Omelyanchouk, E.Il'ichev, H.-G.Meyer, PhysicalReview B 73 (2), 024506, (2006).
4. Sub-flux quantum generator, A.Omelyanchouk, A.Smirnov, US Patent 6,885,325, (2005).
5. Laser scanning microscopy of HTS films and devices, A.Zhuravel, A.Sivakov, O.Turutanov, A.Omelyanchouk, S.Anlage, A.Ustinov, LowTemp. Phys. 32, 592, (2005).
6. Josephson behavior of phase-slip lines in wide superconducting strips, A.Sivakov, A.Glukhov, A.Omelyanchouk, Y.Koval, P.Müller, A.Ustinov, Physical Review Letters 91 (26), 267001, (2003).
7. Quasiclassical theory of spontaneous currents at surfaces and interfaces of d-wave superconductors, M.H.S. Amin, A. Omelyanchouk, S. Rashkeev, M. Coury, A. Zagoskin, Physica B: Condensed Matter 318 (2), 162-179, (2002)
8. Degenerate Ground State in a Mesoscopic YBa 2 Cu 3 O 7-x Grain Boundary Josephson Junction, E.Il'Ichev, M.Grajcar, R.Hlubina, R.IJsselsteijn, H.Hoenig, H.-G.Meyer, A.Golubov, M.Amin, A.Zagoskin, A.Omelyanchouk, M.Kupriyanov, Physicalreviewletters 86 (23), 5369, (2001).

9. Josephson effect in superconductive bridges: microscopic theory, I.Kulik, A.Omel'yanchuk, Sov. J. LowTemp. Phys.(Engl. Transl.);(UnitedStates) 4 (3), (1978)
10. Electron-phonon coupling and phonon generation in normal-metal microbridges, I. Kulik, R. Shekhter, A. Omelyanchouk, Solid State Communications 23 (5), 301-303, (1977).
11. Dc SQUID based on a three-band superconductor with broken time-reversal symmetry. Y S Yerin, A N Omelyanchouk and E Il ' ichev. Supercond. Sci. Technol. 28 (2015) 095006.