CURRICULUM VITAE

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OBJECTIVE: A tenure–track faculty position at the assistant/associate professor level in the field of biophysics, fluorescence spectroscopy, AMO physics, or laser physics, where my expertise in one of the four areas listed below would be useful:

1. Experimental studies of pico– and nanosecond dynamics of proteins and other macromolecules and nanostructures using time–resolved fluorescence.
2. Effect of the local environment on the radiative decay rates of fluorophores embedded in biological macromolecules (e.g., tryptophan residues in proteins) or biological nanostructures (e.g., 1,6–diphenylhexatriene in lipid bilayers).
3. Spectroscopy of molecules with Born–Oppenheimer–inseparable wavefunctions and interaction of these molecules with each other.
4. Intracavity laser spectroscopy. Nonlinear dynamics of multimode lasers.

PROFESSIONAL SUMMARY: Solid theoretical background in quantum mechanics, quantum radiophysics, electrodynamics of continuous media, and mathematics. Twenty three years of experience with lasers, nonlinear optics and fluorescence. Thirteen years of work with biological macromolecules and nanostructures.

RESEARCH EXPERIENCE: [references to bibliography in square brackets]

Effect of solvent refractive index on the radiative decay rate of a single Trp residue in a protein. Derived a theoretical equation that describes how the radiative decay rate k_r for an electric dipole emitter embedded in a small dielectric ellipsoid of a refractive index n_1 varies with the refractive index n_0 of the surrounding dielectric fluid [34,35]. The slope of a k_r versus n_0 plot depends on the orientation of the emitting dipole moment and on the ellipsoid axes ratio. Assuming that the protein has approximately ellipsoidal shape, this can be applied to a single–Trp protein and may be used to determine the protein shape or the orientation of the Trp transition moment relative to the protein. Experimental data obtained with E21W mutant of the IIA^{Glc} protein of the phosphotransferase system of *Escherichia coli* are in quantitative agreement with this theory [34].

Spectrally– and time–resolved fluorescence of tryptophan residues in proteins. Built an instrument using ultraviolet picosecond laser excitation, microchannel plate photomultipliers, and time–correlated photon counting, capable of processing up to 40,000 photons per second without systematic errors of any kind. Collected series of decay curves at multiple emission wavelengths. Worked out experimental methods with solutions of indole in viscous polar solvents [32]. Suggested physical models and wrote computer programs for data analysis. Developed criteria for distinguishing the time–dependent spectral shifts caused by protein relaxation from those due to protein heterogeneity [32,33]. Measured picosecond/nanosecond protein relaxation dynamics [33].

Spectroscopy and structure of rhodamine dimers and higher oligomers. From the spectra of aqueous solutions of rhodamine 6G measured over a 1000–fold range of concentrations resolved the absorption spectra of monomer, dimer, trimer and tetramer [26]. Found the geometry of the dimer by comparing its $S_1 \leftarrow S_0$ and $S_2 \leftarrow S_0$ absorption bands with those calculated from monomer spectra using perturbation theory. This was an edge–to–edge dimer with like charges facing each other. Rhodamine dimers found an important biomedical application [25,27,28].

Orientational dependence of spontaneous emission rate in anisotropic media. Probability of spontaneous emission in a medium is different than that in vacuum; in anisotropic media it depends on the orientation of the transition dipole moment. A lipid bilayer represents an optically thin layer ($d<<\lambda$) of one refractive index immersed in a medium of a different refractive index. I demonstrated that the probability of emission for a fluorescent molecule in a lipid bilayer varies with its orientation and with the refractive index of the surrounding medium. Based on this I suggested and experimentally accomplished a new method of measuring the order parameter $<P_2>$ in lipid bilayers [16,17,20,21].

Intracavity Laser Spectroscopy (a kind of absorption spectroscopy with the sensitivity equivalent to a cuvette of 10^9cm optical path). A gas with narrow absorption lines filled the cavity of a broadband CW dye laser with a homogeneously–broadened gain medium. The laser emission was passed through a high–resolution spectrograph. The method was applied for detecting weak absorption lines in gases [1–3]. Within the 602nm–627nm window of transparency of the Earth's atmosphere we recorded over 900 new absorption lines (there were no known atmospheric absorption lines in this spectral range before our study) [3]. The spectral range was extended to the infrared [4]. Intracavity Laser Spectroscopy was also used to measure two–photon absorption [6,9] and dispersion of the refractive index [11,23]. The sensitivity of Intracavity Laser Spectroscopy is limited only by nonlinear coupling between longitudinal radiation modes of the laser; this mode coupling was a subject of special studies [7,11,15].

TEACHING EXPERIENCE:

Fluorescence Spectroscopy, 020.646. Johns Hopkins University, Department of Biology
Spring 1998, Spring 2000, Fall 2002.
Taught approximately one half of the lectures in the course. My lectures covered physics of fluorescence: stationary states, wavefunctions, Born–Oppenheimer separability, electric dipole moment operator, matrix elements, probabilities of absorption and emission, symmetry considerations, directions of transition dipole moments, polarization of emitted photons.

Advanced Biochemistry, 020.665. Johns Hopkins University, Department of Biology
Fall 1994, Fall 1995.
Taught 3 lectures in the course. My lectures on computer analysis of ligand–binding data covered quantitative models of ligand binding, algorithms for model fitting (Gauss–Newton, Marquardt), statistical goodness–of–fit criteria (χ^2 test, residuals, autocorrelation of residuals).

Ph.D. Students. Have been a partial thesis advisor, taught theory and practice of time–resolved fluorescence measurements to at least four Ph.D. students (one in Russia and three in the U.S.). The four students have defended their Ph.D. thesis, and time–resolved fluorescence has played a major role in their thesis.

EMPLOYMENT HISTORY:

1994 to Present	Department of Biology, Johns Hopkins University, Baltimore, MD Associate Research Scientist
1993–1994	Lebedev Physics Institute, Russian Academy of Sciences, Moscow, Russia Research Scientist
1990–1993	Department of Biology, Johns Hopkins University, Baltimore, MD Visiting Research Scientist, on leave from Russian Academy of Sciences.
1980–1990	Lebedev Physics Institute, Russian Academy of Sciences, Moscow, Russia Research Scientist

EDUCATION:

1994	PhD Physics Lebedev Physics Institute, Russian Academy of Sciences, Moscow, Russia
1980	MS Quantum Radiophysics Moscow Institute of Physics and Technology, Moscow, Russia

PERSONAL INFORMATION:

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