VICTOR FLAMBAUM CURRICULUM VITAE

DEGREES:

1987 Doctor of Physical and Mathematical Sciences, Institute of Nuclear Physics, Novosibirsk.
1978 Ph.D, Institute of Nuclear Physics, Novosibirsk.
1974 B.Sc. (Physics). Novosibirsk University.

APPOINTMENTS:

1991-present Professor, Head of Department of Theoretical Physics, UNSW.
Since 2003 Scientia Professor.
2005-2014 ARC Australian Professorial Fellow.
1974-1991 Institute for Nuclear Physics of USSR Academy of Science.
Positions: Trainee-researcher, PhD student, Jnr Scientist, Snr Scientist, Leading Scientist.
1975-1991 Novosibirsk State University. Positions: Assistant, Docent (A/Prof.), Professor.

Publications in atomic, nuclear, elementary particle, molecular, solid state, statistical physics, general relativity and astrophysics including:

1. Prediction of million times enhancement of violation of fundamental symmetry (parity P) in neutron-nucleus reactions near p-wave compound resonances. This effect has been studied in JINR (Dubna), KEK, Los Alamos and many other laboratories.
2. The first theory of the nuclear anapole moment (a magnetic moment violating fundamental symmetries, P and C) and proposals for atomic and molecular experiments which led to the discovery of this moment by the group led by C. Wieman. This was the first observation of an electromagnetic moment violating fundamental symmetries and a new method to study parity violating nuclear forces.
3. A new method for the high precision atomic calculations: perturbation theory in screened electron interaction with all-orders summation of dominating diagrams. Numerous applications.
4. First accurate relativistic many-body calculations of violation of fundamental symmetries, Parity (P) and Time reversal (T), which are used for testing unification theories in atomic experiments.
5. Prediction of Fr atom spectra (before measurements) which helped to detect these spectra. Prediction of unknown spectra and probabilities of electromagnetic transitions in unstable and superheavy elements, and in highly charged ions.
6. Definition and first calculations of the nuclear Schiff moments produced by T and P violating nuclear forces, and calculations of atomic electric dipole moments (EDM) produced by these nuclear moments. New method to test unification theories.
7. Prediction of new phenomenon - enhanced collective nuclear moments violating P and T invariance. This prediction motivated a new generation of measurements and calculations of atomic EDMs for testing unification theories.
8. Theoretical discovery and study of chaotic many-electron compound eigenstates in atoms and ions.
9. Statistical theory of finite systems (excited nuclei, atoms, molecules) based on properties of chaotic compound states. This is a new general statistical theory that has a huge number of potential applications including methods to calculate matrix elements and amplitudes between chaotic eigenstates. Specific predictions include the enhancement of weak interactions and effects of violation of the fundamental symmetries, electron recombination and combination (inelastic) photon scattering, and suppression of the photoionization via many-electron resonances. Time-dependent problems such as an increase of entropy, transition to the equilibrium state and (non-exponential) decay of the doorway states have also been considered.
10. Formulae for atomic scattering length and effective range. ¾ of atoms have positive scattering length and stable Bose (or Fermi) condensate, ¼ have unstable condensate.
11. Theory of the exchange-assisted tunnelling. The exchange interaction and correlations radically change the behaviour of a quantum particle in a classically forbidden region. Instead of the conventional exponential decrease, the electron wave function decreases as r^{-2} inside an atom or molecule, and as r^{-3}, $r^{-3.5}$ and r^{-4} in 1D, 2D and 3D crystals, respectively. An example of the application is the enhanced annihilation of a positron with the inner shell electrons.
12. Proposal of new methods to search for space-time variation of fundamental constants including the Many-Multiplet method in astronomy and comparison of frequencies of two optical clocks in the laboratory. Proposals and calculations of the enhanced effects in atoms, molecules and nuclei
13. Proposals of new atomic clocks of higher projected accuracy and smaller size, including "magic angle" and "micromagic" clocks, highly charged ion clocks, clocks with zero thermal shift, and specific

schemes for nuclear clocks. Proposals of the clocks with strongly enhanced sensitivity to the variation of the fundamental constants.

14. First periodic table for a new type of atomic system – positron-atom bound states. Calculations of positron-atom bound states and resonances for all atoms, identification of atoms that can bind positrons.

15. Cosmic sources of violation of the fundamental symmetries, new effects of Dark matter in atoms and pulsars. The suggested effects are linear in a very small constant that quantifies the interaction between dark matter particles and ordinary matter. Previously discussed effects are quadratic.

16. A new method to detect cosmic topological defects using the pulsar timing: the topological defects change the pulsar rotation frequency.

17. Quantum effects create black hole absorption properties before the actual formation of the black hole. Discovery of a dense spectrum of narrow resonances in near-singular metrics. Amazingly, capture of quantum particles to these very-long-lifetime resonances imitates the black hole absorption with the same capture cross section.

18. It is shown that Dark matter may be a source of the space-time variation of the fundamental constants. Using this connection the limits on the quadratic interaction of light Dark matter with photons, nucleons, electrons and Higgs boson have been improved up to 15 orders of magnitude. Limits on interaction of Dark matter with W and Z bosons have been established for the first time.

19. Limits on the anisotropy of the speed of light (studied in the famous Michelson-Morley experiment) have been improved by 7 orders of magnitude. This anisotropy leads to anisotropy of the Coulomb interaction, which affects atomic spectra.