

# CURRICULUM VITAE

George SMIRNOV

## Personal Information:

**Nationality:** Swiss, Russian

**Birth date:** May 26, 1946

**Current address:** EN/STI/EET  
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**Home institution:** Laboratory of High Energy Physics  
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## Languages:

**English:** Fluent level written and spoken

**French:** Good level written and spoken

**German:** Initial level

**Russian:** Mother tongue

**Ukrainian:** Mother tongue

## Research Experience:

**2011 – 2016:** Project associate (2011–2014) at CERN in the Engineering (EN) Department at CERN. Studies of the spin structure of the nucleon within the framework of the international collaboration COMPASS (until 2013). Studies of the CERN SPS proton and ion beam passage through bent crystals and development of the crystal-assisted collimation technique in the framework of the CERN UA9 project. Development of the algorithms for the proton beam transport in bent crystals for the FLUKA simulation tools. Using FLUKA simulation tools for the studies of the radiation damage of the silicon crystals under operational conditions at the LHC collider. Development of the Monte Carlo simulation code for the studies of the neutrino interactions for the FLUKA simulation tools. Calculations of the radiative corrections and nuclear corrections for the ICARUS (Gran Sasso, Italy) neutrino project and the project of the close neutrino detector at CERN.

Development of the Monte Carlo code for the studies of the interactions of 7 TeV protons in the hadron calorimeter in the framework of the CRYSBREAM project (INFN, Rome).

**2006 – 2010:** Scientific associate (2006–2007) and Project associate (2007–2009) at CERN in the Accelerators and Beams (AB) Department (EN Department from 2009). Research work for the LHC Collimation and LHC Heavy Ion projects. Evaluation of the heat damage to the LHC superconducting magnets due to heavy ion energy losses. Development of algorithms for simulating radiation damage in construction materials and fast algorithms for simulating Multiple Coulomb Scattering (MCS) of swift ions. Development of the neutrino generator for the FLUKA code simulating neutrino interactions with protons and nuclei. Participation in experimental studies of the LHC proton beam collimation with the help of bent crystals (CERN UA9 project). Experimental tests of MEDIPIX coordinate pixel detectors for the tracking of beam particles in the framework of the UA9 project. Development of FLUKA code algorithms for simulating steering of high energy beams by using bent crystals.

Development of the Monte Carlo code based on FLUKA package for studies of the interactions of the beam halo with the construction elements of the proton linac under the conditions of the frequent change of the beam energy and beam profile. Simulations of the radiation fields around the high frequency proton linac for hadrontherapy (TERA Foundation project).

**2003 – 2005:** Research associate at CERN — visitor at the Accelerators Beam Physics Group of the AB Department. Participation in the LHC Collimation Project in collaboration with the Emerging Energy Technologies section. Development of algorithms for the tasks of simulation of the heavy ion beams at the LHC (electromagnetic dissociation of ions, energy losses, MCS, production of  $e^+e^-$  pairs by ultrarelativistic ions). Invited professor at the Blaise Pascal University, Clermont-Ferrand, France, and an unpaid scientific associate at CERN Geneva, Switzerland, participating in the research program within the framework of the international collaboration COMPASS.

Work at the LPC Laboratory (IN2P3-CNRS) of Clermont-Ferrand on data analysis of the TJNAF (USA) and Mainz (Germany) experiments on the exclusive pion electroproduction.

Work under NASA grants on developing algorithms for the simulation of the photon induced dissociation in relativistic heavy-ion collisions (in the framework of the FLUKA project at CERN). Application for calculations of beam losses and interactions with beam environment at the LHC collider.

Developing analysis software for the COMPASS experiment. Analysis of the data and improvements of algorithms for selecting events with  $D^0$  production.

Theoretical studies and evaluations of experimental feasibility of measuring the  $d/u$  quark distribution ratio in the high  $x$  limit.

**1999 – 2002:** Work on the theory and phenomenology of the modification of the nucleon partonic structure in nuclear medium.

Participation in the work of the teams considering a feasibility of construction an Electron Laboratory for Europe (ELFE) at CERN, Geneva, Switzerland. Preparation of the conceptual design report “**ELFE at CERN**”.

Phenomenology of the virtual Compton scattering in the resonance region. Data analysis from the JLAB E-93050 experiment on the exclusive electroproduction of photons and pions in the resonance region (group of Dr. P. Bertin, LPC – Clermont-Ferrand, France).

Work on commissioning of the COMPASS detector at CERN.

Visiting position at the University of Gent, Belgium (group of Prof. R. Van de Vyver). Data analysis on the coherent electroproduction of  $\rho^0$  meson on proton, deuteron,  $^3\text{He}$ ,  $^{12}\text{C}$  and  $^{84}\text{Kr}$  targets of the HERMES experiment.

**1990 – 1998:** Leader of the Dubna team in the SMC collaboration at CERN (spokesperson Professor V.W. Hughes, Yale University.) Measurements of the spin-dependent nucleon structure functions from inclusive deep-inelastic scattering and tests of the fundamental **Bjorken sum rule** and of the **Ellis–Jaffe sum rule**.

Construction of the large area drift tubes muon detector for the NA47 experiment at CERN, Switzerland (SMC Collaboration). Analysis of the data from muon decay for the measurement of the beam muon polarization. Calculations of corrections to the measured cross-section asymmetries for radiative effects and for the asymmetry dilution due to unpolarized target nuclei. Responsibilities on the publication drafting committees for the SMC Collaboration.

Preparation of the Proposal for the studies of exclusive reactions of polarized muons with polarized nucleons (COMPASS experiment at CERN) with the main purpose to measure gluon spin structure of the proton. Dubna team leader in COMPASS (until January 1997).

Demonstration of similarities in the deviations of the nuclear structure functions  $F_2^A(x)$  from the deuteron structure function  $F_2^D(x)$  for  $A > 3$ , proving that the physics of the EMC effect is explained by the difference in the partonic structure of a 2- and 3-nucleon systems. Formulation of the the two-stage concept of the modifications of the partonic distributions in nuclear environment. Work on the model independent approach considering the evolution of the free nucleon structure function in the lightest nuclei as a result of pair interactions between nucleons, and nucleons and nuclear fragments.

Quantitative description of the  $A$  dependence of the EMC effect in the entire range of the Bjorken  $x$  and of  $x$  dependence for any nucleus.

**1984 – 1990:** Senior researcher, group leader. Analysis of the data from the NA4 experiment at CERN (BCDMS Collaboration). Monte Carlo calculations of the effects of finite resolution of the BCDMS magnetic spectrometer. Responsible for studies of nuclear effects in the nucleon structure functions below and above the kinematic limit for scattering of a muon on a single nucleon. Tests of **quark models** of the nucleon and nuclear structure. Analysis of the  $A$  dependence of the ratio of photon absorption cross sections  $\sigma_L/\sigma_T$  which has served for motivation of the SLAC E-140 experiment.

Preparation of a Letter of Intent for the experiment at CERN with the goal to extend the measurements of relative modifications of the partonic distributions by nuclear environment into the range of  $x > 1$ . Analysis of the data on nuclear shadowing and on the  $A$  dependence of the EMC effect. Responsibilities on the publication drafting committees for the BCDMS Collaboration.

Participation in the program of the tagged neutrino facility (TNF) in Protvino, Russia, designed for the studies of the neutrino deep inelastic scattering and rare kaon decays. Responsibilities for construction of the large hadron calorimeter for the TNF.

**1979 – 1984:** Researcher, JINR (Dubna), groups of professors I. Savin and I. Golutvin. Dubna team leader in BCDMS since 1982. Head of the JINR group at CERN (1982–1983). Participation in the preparation of the proposal for the DELPHI project at LEP, triggering of the Dubna team activity in DELPHI program. Deep inelastic scattering of muons on protons and nuclei (D,  $^{12}\text{C}$ ,  $^{14}\text{N}$ ,  $^{56}\text{Fe}$ ). Data taking and data analysis for the measurements of the nucleon and nuclear structure functions, of the weak mixing angle  $\sin^2\Theta_W$  and the QCD parameter  $\Lambda_{\overline{\text{MS}}}$  (BCDMS Collaboration led by Professor Carlo Rubbia, CERN, Switzerland). Responsibilities for the software development and data analysis. Tests of the **Standard Model** of the electroweak interactions.

**1970 – 1979:** Researcher, JINR (Dubna), group of professor Bruno Pontecorvo and Leonid Nemenov. Experimental and phenomenological studies of the pion and nucleon form factors in the time-like region. Construction of the spectrometer for detection of the  $e^+$  and  $e^-$  produced in the interactions of  $\pi^-$  with protons and nuclei: lead glass calorimeters, water Cherenkov counters, large plastic scintillation counters, spark chambers, cryogenic targets. Monte-Carlo simulation and data analysis. Evaluation of the cross section of the inverse pion electroproduction reaction in the framework of **dispersion relations** and an **isobar** model.

### Teaching Activity:

**1974 – 1998,** Supervising of graduate students from the Moscow State University (MSU) and Moscow Engineering and Physics Institute (MEPHI) during their diploma work and (after 1990) of four postgraduate students during the Ph.D. thesis work. Lectures on the hadronic structure in Russian (1991–1994) and in English (1997–1999) at the University Center of JINR, Dubna.

**1999 – 2003:** Seminars for undergraduate students (optics, electricity) at the University Blaise Pascal (Clermont II) 12 hours per week (academic years 2000-2003).

Seminars for postgraduate students:

- Structure of hadrons: principal quark models;
- Spin structure of the nucleon;
- Physics of neutrino.

Attestations confirming the qualification for the function of the University Professor in the section 29 (*Constituants Élémentaires*) issued by *Ministère de l'Éducation Nationale*, France, in the years 2002 and 2006.

### **Thesis Research:**

Doctor of Science: Studies of the structure of nucleons and nuclei from experiments on deep-inelastic scattering of muons, Dubna, 1994.

Ph.D.: An analysis of experimental data on  $\pi^- + p \rightarrow e^+ + e^- + n$  reaction in the isobaric model framework, Dubna, 1976.

**Education:** 1970 – M. S. degree in Physics from Moscow State University, Moscow, Russia.

1968 – Diploma in Microwave Engineering from Moscow State University, Moscow, Russia.

### **Major Scientific Prizes:**

First prize of JINR for the best research work – 2 times;  
Second prize of JINR for the best research work – 4 times;  
The JINR prize the best scientific article – 1 time.

### **Scientific Publications:**

Full list of publications is attached to my CV and is available at <http://cern.ch/gsmirnov>. The publications can be classified according to my research activities as follows:

- 1) Studies of the pion and nucleon form factors: 21 papers;
- 2) Measurements of the proton polarizabilities and studies of the nucleon resonances: 12 papers;
- 3) Measurements of the partonic structure of the nucleon and nuclei: 38 papers;
- 4) Measurements of the spin-dependent structure of the nucleon: 57 papers;
- 5) Phenomenology and theory of nuclear medium effects on the nucleon structure functions: 20 papers.
- 6) Development of the software for the simulation of heavy-ion interactions with medium: 3 papers.
- 7) Development of the FLUKA code: 11 papers
- 8) Development of the neutrino generator for the FLUKA code: 5 papers.
- 9) Experimental and theoretical studies of the crystal-assisted collimation of the proton and ion beams at SPS CERN: 15 papers.

### **Computing Skills:**

Numerical analysis of large data sets.

Knowledge of the Fortran and C/C++ programming languages,  
Unix operating system, Windows NT, HTML.

### **Activity in administration and some principal responsibilities**

I have been representing JINR, Dubna, at CERN during the years 1982–1983. I was the Dubna group leader in the CERN BCDMS collaboration (1984–1989), in the CERN SMC collaboration (1989–1998) and in the CERN COMPASS collaboration (1996–1997).

I am the scientific editor of the English version of the Russian journal ” *Physics of Particles and Nuclei*” ISSN 1063-7796 (the journal is published by the *American Physical Society*).

### **Professional Society Membership:**

New York Academy of Sciences

### **Recent references:**

Stephan Maury, Head of the I-LHC Project, CERN BE/ABP,  
Geneve 23, CH-1211, Switzerland.  
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Alfredo Ferrari, Deputy group leader, CERN EN/STI,  
Geneve 23, CH-1211, Switzerland.  
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Federico Carminati, Chair of ALICE Computing Board, CERN PH/AIP  
Geneve 23, CH-1211, Switzerland.  
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### **References in the years 2000–2006:**

Professor Carlo Rubbia, CERN EN/STI,  
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Professor Vladimir Kekelidze, Director of the  
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