**Status: February 16, 2001**

## Personal data

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| Name | **LEVONIAN Sergey** |
| Date of birth | 12/12/1952 |
| Place of birth | Russian Federation, Krasnodar |
| Nationality | armenian |
| Citizenship | Russia |
| Marital status | married |
| Education | Moscow State University, Physical Faculty, graduated in 1975 |
| Degree | Doctor of physics, obtained in 1987 |
| Subject | Experimental High Energy Physics |
| Thesis | 'Study of Antideutron-Proton Interactions at 12 GeV/c' |
| Languages | Russian – native, English, Ukranian – fluent, Germain – some |

## Career

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|---|---|
| 1969 - 1975 | Physics Department of the Moscow State University, student |
| 1975 - 2001 | Lebedev Physical Institute, R.A.S., Moscow, Leading research scientist |
| 1991 - 1994 | Visiting scientist at DESY, Hamburg, Germany |
| 1995 - 1997 | Maitre de recherche, LPNHE, Ecole Polytechnique, Paris, France |
| 1997 - 2001 | Visiting scientist at DESY, Hamburg, Germany |

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|---|---|
| 1974 - 1975 | Experimental study of the ion acceleration in high intensity electron beams (LPI, Moscow) |
| 1977 - 1987 | Experiments on the bubble chamber 'LUDMILA' (JINR, Dubna and IHEP, Serpukhov) |
| 1987 - 2001 | H1 experiment at HERA, DESY, Hamburg |

## Summary of reseach activities

1974-1977 Accelerator physics
- new methods of acceleration [158]
- particle dynamics in microtrons [159, 160, 161]
- software (development of the TRANSPORT package)

1977-1987 Bubble chamber experiments on the 'LUDMILA' facility at Serpukhov accelerator
- $\bar{p}p$ interactions at 22.4 GeV/c
- $\bar{d}p$ , $\bar{d}d$ , $\bar{d}A$ interactions at 12.2 GeV/c

Responsibility:
- full study program for $\bar{d}p$ interactions
- on-line software for beam diagnostics at IHEP (channel 9)
- off-line software: automatization of scanning procedure, event reconstruction based on the HYDRA system
- analysis of $\bar{d}p$ data at 12.2 GeV/c
- proposal for antideuteron-nucleus experiment (accepted)

1987-2001 H1 experiment at HERA, DESY

Responsibility:
- luminosity measurements in H1
- offline software for the H1 Lumi Monitor and Electron Taggers
- H1 graphics (LOOK and Event Display librarian, 1990-1995)
- H1 filter farm software from 1998 and beyond the upgrade 2000
- convenor of the photoproduction and diffraction WGs in H1 (1995-2001)
- one of the run coordinators during the data taking (1993-2000)
- member of the H1 Executive Committee (1992-94, 1997-99)
- editor of 7 [4, 11, 24, 28, 38, 55, 79] and referee of 3 [18, 37, 72] H1 papers

Conferences and Workshops:
- convenor in photoproduction working group of the HERA'91 workshop
- convenor of the Hard Diffraction working group of the LISHEP'98 workshop
- invited plenary speaker at HEP'96 Conference in Warsaw
- invited plenary speaker on LISHEP'98 Workshop in Rio de Janeiro
- invited plenary speaker at PIC'99 Conference in Ann Arbor, USA

## References can be obtained from

| | | | | |
|---|---|---|---|---|
| 1) | I.M. Gramenitsky | professor [a] | JINR, Dubna | `gramenit@lhe08.jinr.dubna.su` |
| 2) | F. Eisele | professor [b] | Heidelberg | `eisele@physi.uni-heidelberg.de` |
| 3) | J. Feltesse | professor [c] | Saclay | `feltess@dphrsb.saclay.cea.fr` |
| 4) | R. Eichler | professor [d] | ETH-Zürich | `eichler@particle.phys.ethz.ch` |
| 5) | J. Dainton | professor [e] | Liverpool, UK | `dainton@mail.desy.de` |
| 6) | V. Blobel | professor | Hamburg Univ. | `blobel@mail.desy.de` |

[a] spokesman of the LUDMILA Collaboration (1972–1988)
[b] spokesman of the H1 Collaboration (1987–1992)
[c] spokesman of the H1 Collaboration (1992–1995)
[d] spokesman of the H1 Collaboration (1995–1997)
[e] spokesman of the H1 Collaboration (1997–1999)

# Description of some research topics

H1 Luminosity System was designed as a multipurpose detector, allowing in addition to its prime task to also tag photoproduction processes and DIS events with initial state radiation (ISR). The system works extremely reliably already during 9 years. It provides fast and precise luminosity measurement for every pair of colliding bunches over a large dynamical range from $L = 10^{26}\ cm^{-2}s^{-1}$(in 1991) to more than $10^{31}\ cm^{-2}s^{-1}$. To achieve ultimate precision of $(1 \div 1.5)\%$ for physics normalization a number of effects had to be taken into account: variations of the beam tilt and offset in the interaction point (IP), presence of the parasitic satellite bunches in the machine, luminosity dependent photon pileup etc.

As an example, satellite bunch corrections vary between 2% and 7% being absolutely essential for correct luminosity determination. The procedure has been developed in 1994 based on the combined analysis of $z-$vertex distribution and ToF system measurements to correct for satellite bunch effect. Moreover, $ep$ collisions from early satellite were also positively used in 1995 to extend $F_2$ measurement to lower $Q^2$ domain, without shifting IP and thus not loosing HERA efficiency. Based on two years experience a proton pick-up device was proposed (PPU) to measure longitudinal proton bunch structure with best possible accuracy. Using the PPU data, another subtle effect was observed and measured in 1997: the widening of proton bunches in $z$ direction in the course of a fill. The effect is as large as 1%/hour and can not be neglected in the luminosity correction procedure, as a typical lumi fill time is $8 \div 10$ hours.

This effect has recently been confirmed by the HERA machine group, after independent dedicated measurements. It might be related to so called proton coasting beam, leading to additional background in HERA detectors. To understand all the details of this phenomenon is therefore very important both for precise luminosity determination and to achieve good running conditions for the experiments. A common study with the machine group is presently going on.

Photoproduction physics. Here I concentrated on tagged photoproduction, by measuring total $\gamma p$ cross section, determining gluon content of the photon at low $x_\gamma$ with a novel method, based on high $p_T$ charged particles, and by comparing real and virtual photon-proton interactions to study how the properties of the photon and dynamics of its interaction with protons evolve with $Q^2$. In particular, an interesting result has been obtained on scale influence on the energy dependence of $\gamma p$ cross sections. A clear similarity with DIS case finds a qualitative explanation both in terms of perturbative QCD and in Reggeon Field Theory approach, making a natural link between the two.

Presently I am analysing special minimum bias data samples taking at the end of 1997 and 1999 to improve $\sigma_{tot}(\gamma p)$ measurement both in terms of precision and also in several $W$ bins over the extended energy range from 90 to 290 GeV/$c$.

Diffractive phenomena at HERA is still a rapidly developing research area. While expected in photoproduction regime [170, 174], diffraction came as a surprise in DIS at HERA [18, 169] and led to a real 'Renaissance' in this field. The reason being that diffraction at HERA is deeply related to QCD at small $x$ and provides a valuable information about underlying dynamics of strong interactions both at long (soft peripheral processes) and short (hard diffraction) distances. The strategy we have chosen in studying diffrative phenomena in H1 is to develop a coherent picture of the Pomeron able to describe consistently both inclusive cross sections and the properties of hadronic final states in the rapidity gap events. The highlights of the most important results, obtained by H1 diffractive working group, can be found in three plenary talks given in Warsaw [175], Rio de Janeiro [177] and Ann-Arbor [179] and reviewing the status of the subject in HEP.

# Research interests

Recent high $Q^2$ data and the observation of unusual isolated lepton events in H1 have demonstrated high discovery potential and a sensitivity to new physics at HERA. To exploit this potential in a most efficient way, in particular before the Tevatron-II run, is one of the priority tasks to which I would like to contribute within the H1 collaboration.

Somewhat longer term project, using all collected luminosity until the year 2005-2006 is to study the proton structure and to perform precision tests of electroweak physics, where HERA has no real competition in the world.

It is clear, that after HERA upgrade an emphasis will be on hard scale physics and rare processes, requiring highest possible luminosity. It is therefore very important to collect enough low $Q^2$ data now, to study the transition region between perturbative and non perturbative regimes and thus to help completing QCD as a real theory of strong interactions. Diffraction at HERA and a puzzle of Pomeron is one of the areas in which I plan to continue investigations at least until the Upgrade is finished. There are lots of possibilities to shed more light on this phenomenon, which so far were not fully exploited yet. Among those are the measurement of Deeply Virtual Compton Scattering (DVCS), Odderon search, high $|t|$ vector meson production, double diffractive dissociation, central diffraction etc.

To make a physics analysis efficient it is important to improve and to optimize data taking and data processing scheme, using quickly developping modern computing technologies. To that end I also plan to actively participate in realizing new metacomputing project in H1. At the same time I will finish merging present L4 and L5 trigger levels into a common event reconstruction and filtering software package.

Finally, I am going to further support "my first love" – luminosity measurement in H1, as well as to participate in the machine physics studies together with HERA experts. Some of the subtle beam dynamics effects seems to be not fully understood. A better use of available beam diagnostics and closer cooperation between the experements and the machine group would be very helpful in that respect. It is worth mentioning that good understanding of the machine is vital for a successful operation after HERA upgrade, when running conditions will become significantly more difficult.

As far as distant future is concerned, there are several known possibilities to bridge HERA and NLC physics. My personal preference would be to fill heavy ions into the HERA ring, rather than choosing polarization option. On one hand, it is because I have more experience in hadron-nucleon and hadron-nucleus physics as compared to spin physics. On the other hand, deep inelastic scattering on heavy nuclei has closer relation to some important QCD problems, such as colour transparency and parton dynamics in strong fields, and hence is tightly linked to diffraction at HERA, being studied presently.

In any case, if TESLA project is accepted, my prime interest would be to participate in the preparation to $e^+e^-$ physics at NLC, after completing H1 physics program.

# A complete list of the official publications in physics

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|---|---|---|---|
| • HERA physics | [1] | – | [102] |
| • $\bar{d}A$ interactions at 12.2 GeV/c | [103] | – | [108] |
| • $\bar{d}N$ interactions at 12.2 GeV/c | [109] | – | [121] |
| • $\bar{p}p$ interactions at 22.4 GeV/c | [122] | – | [150] |
| • Experimental methods | [151] | – | [157] |
| • Accelerator physics | [158] | – | [164] |
| • Major talks | [165] | – | [184] |

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**[2] Total photoproduction cross-section measurement at HERA. S. Levonian, In Proceedings, Physics at HERA, vol.1, Hamburg (1991) 499-507.**

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