



On the 25-th of July
the sad news shocked our community:
outstanding physicist and our friend

Alyosha Kaidalov

passed away in Moscow
in the 71-st year of his life

“Vitam regit fortuna, non sapiente” (“Fortuna, not wisdom, rules lives) (*Cicero*)







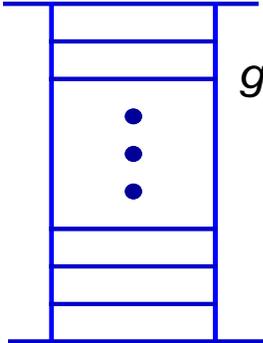
“Modest and friendly, Alexei Borisovich, never refused to help, spending much of his time discussing the work of colleagues, both theorists and experimentalists.

Alexei Borisovich had an invaluable role in creating not only scientific but also the moral climate at the Institute.”

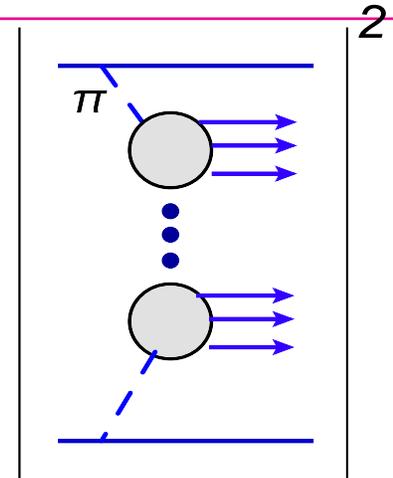
Reggeons

- A. Kaidalov, + ITEP (1963 - 1969)
 - The interaction of Reggeons with particles that have spin;
 - “ On the test of the basic assumptions of complex angular momentum method”, PRL, 26B,20,1967;
 - “ Evaluation of the moving cut contribution in the photoproduction of pseudoscalar mesons”, PRL, 26B,20,1967;
 - “ Factorization and moving cut”, Yad.Fiz. 12, 624 ,1970;

Pomeron structure I: multiperipheral model

$Pomeron =$

 $= s^{\Delta}$
?

$(\Delta = g^2/4\pi - 2)$

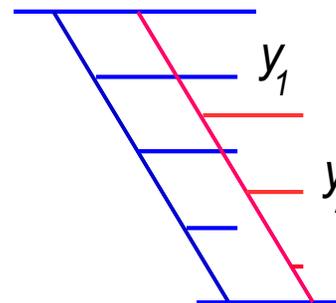


- A. Kaidalov, + ITEP (1969 - 1972)

→ built the MP model that demonstrates the possibility of having $\Delta \geq 1$;

→ found the general feature of such models;

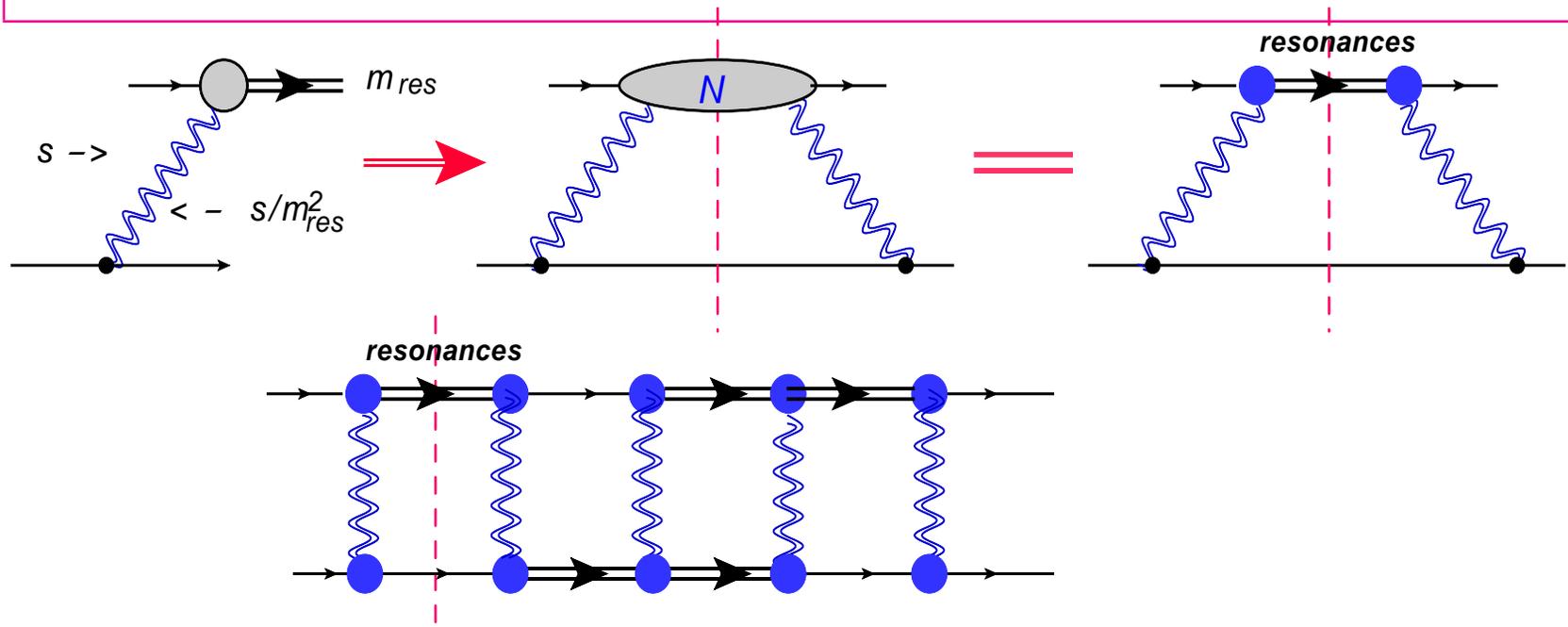
→ based on the model the long range rapidity correlation and the estimates for the correlation length were found ;



$$R = \exp(-|y_1 - y_2|/L) + Const$$

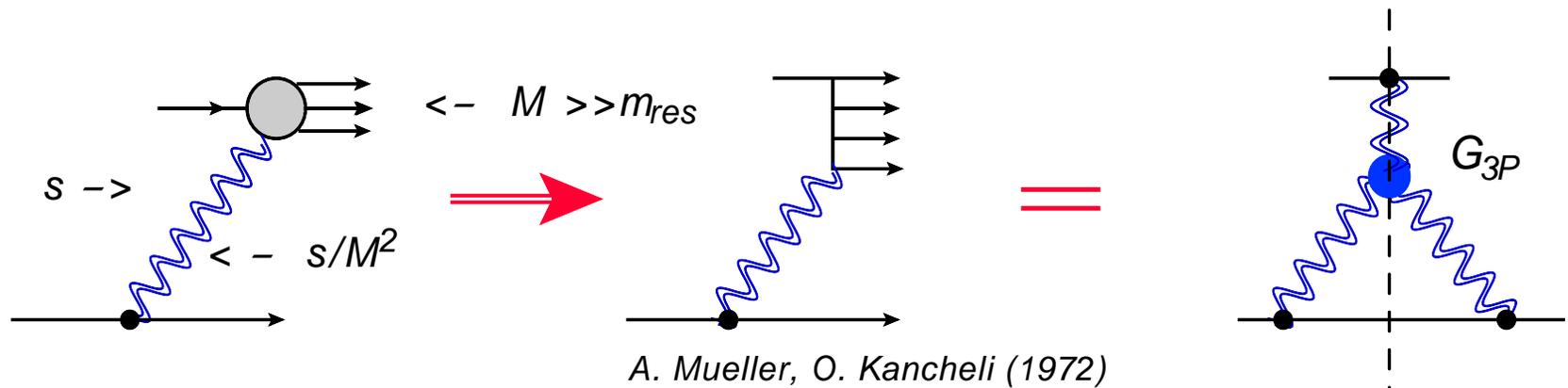
$$L = 1/\alpha_R(0)$$

Small mass diffraction and eikonal approach



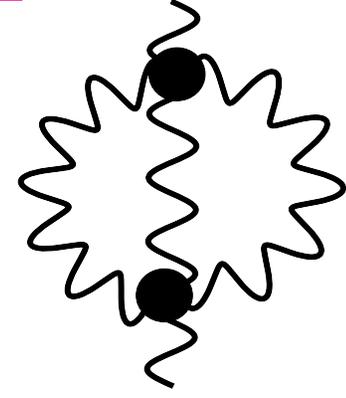
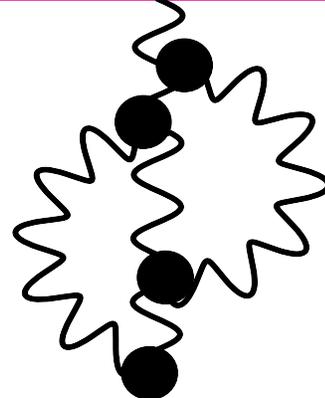
- K. Ter-Martirosyan and A. Kaidalov, (1967 - 1972)
 - first estimate of the multiPomeron-hadron interaction;
 - two channel (quasi-eikonal) model for both elastic and diffraction cross section;
 - the first interrelation between elastic (total) cross section and diffraction
 - the model is valid to the present;

Large mass diffraction and Pomeron interaction



- A. Kaidalov + Khoze, Pirogov, Ter-Isaakyan
- The first value for G_{3P} from the ISR data;
- We learned that Pomeron-proton cross section is about $2mb$ or $0.1\sigma(\pi p)$;
- The first time that a new scale of soft interaction appears;
- The first indication that we could treat the Pomeron interaction perturbatively;

Pomeron interactions



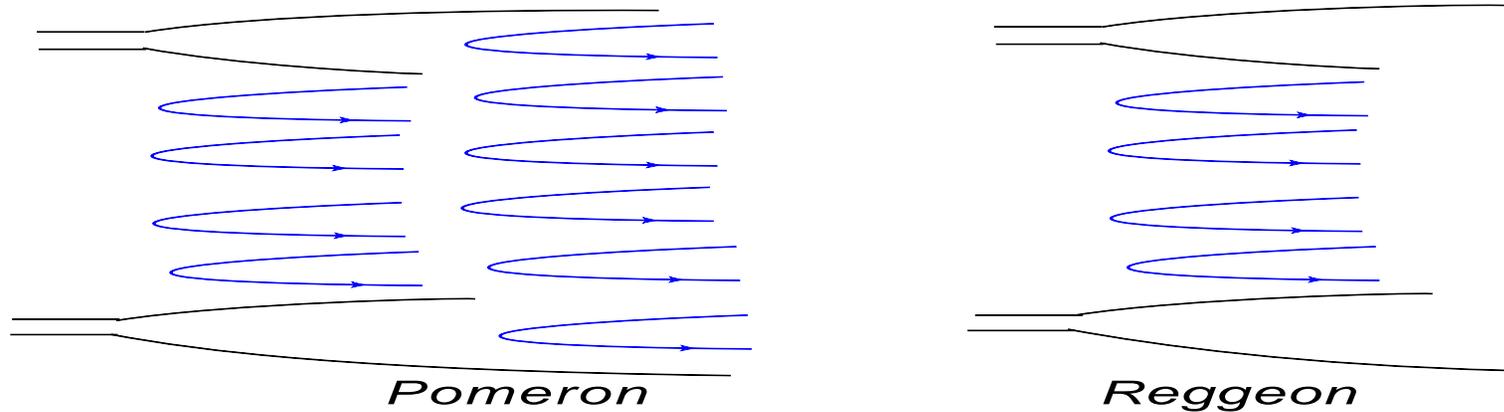
- A. Kaidalov + Ponomarev, Ter-Martirosyan (1986)

$$G(mP \rightarrow nP) = \lambda^{n+m} G_{3P}$$

- The method is suggested of how to sum all Pomeron interactions;
- The first estimate for the influence of the multi-Pomeron interactions on physical observables: σ_{tot} , σ_{el} , B_{el} and σ_{diff} ;
- the model is still valid (see Durham group, Tel Aviv group and Ostapchenko models);

A. B. Kaidalov,
“Diffractive Production Mechanisms,”
Phys. Rept. **50** (1979) 157.

Pomeron structure II: Pomeron as Quark-Gluon strings



- A. Kaidalov + Ter-Martirosyan + ITEP (1982) + Orsay (1990-present)
 - The simplest way to satisfy the Veneziano $1/N_c$ expansion ;
 - Describes the experimental data with minimum information from the experiment;
 - Direct connection with DIS;
 - QGS = Dual-Parton model (Capella, Tran Thanh Van, Krzywicki (Orsay), Sukhatme and Chung-I Tan);
 - Alyosha has 38 paper with Orsay group, (J.Phys.G36:064054,2009)

Pomeron structure III: non-perturbative Pomeron trajectory

- A. Kaidalov + Yu. Simonov (1993 - 2005)
- “Odderon and pomeron from the vacuum correlator method,”
Phys. Lett. B **636** (2006) 101;
- “ Glueball masses and Pomeron trajectory in nonperturbative QCD approach” ,
Phys. Lett. B **477** (2000) 163;
- “ Glueball spectrum and the Pomeron in the Wilson loop approach,”
Phys. Atom. Nucl. **63** (2000) 1428;
- “ The QCD string with quarks: Light cone Hamiltonian,”
Phys. Atom. Nucl. **58** (1995) 300;

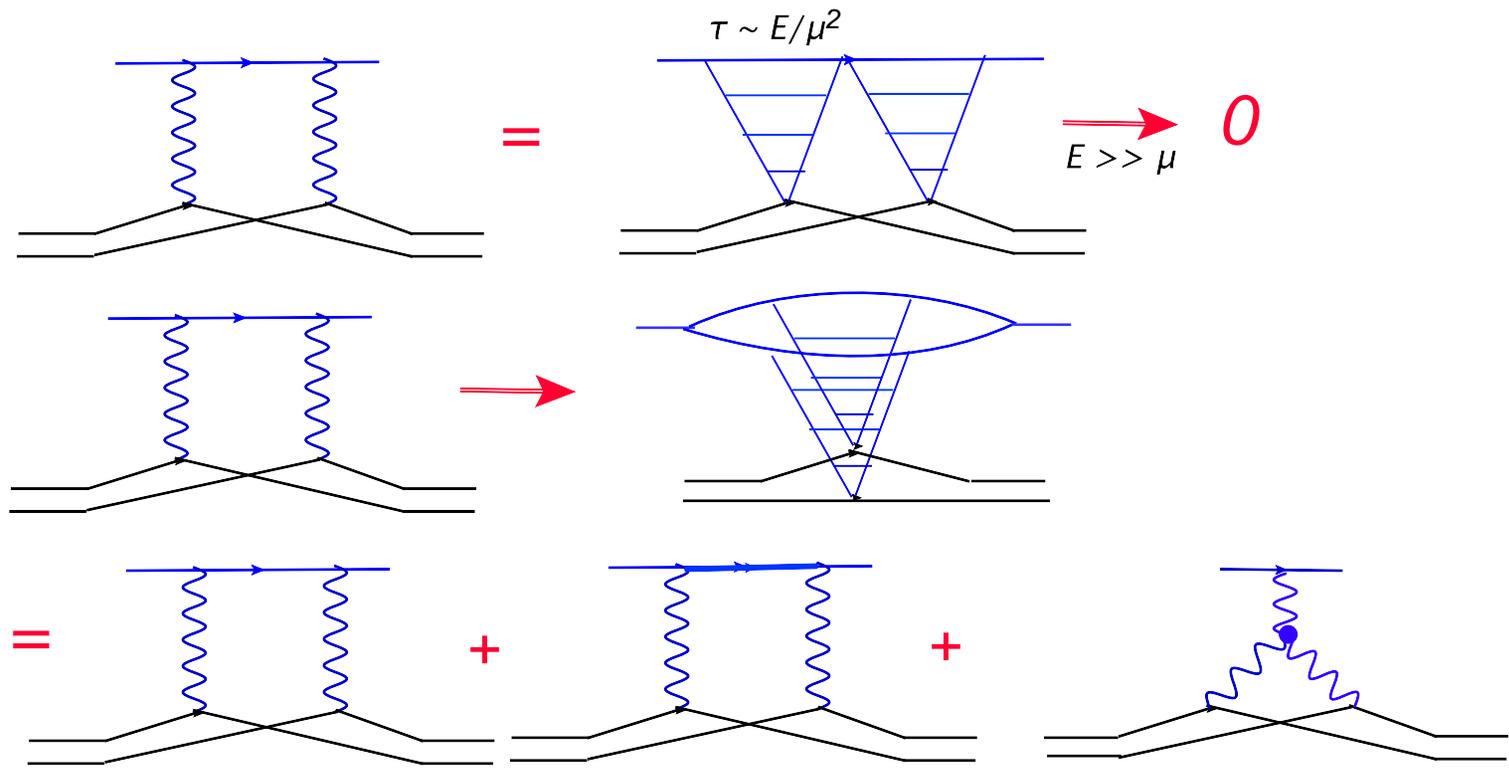
Glauber-Gribov theory

Gribov, Koplik and Mueller, Kancheli, Bjorken (1973-1976)

- Fast-moving hadron or nucleus can be considered as a system of constituents, which is described by wave function :

$$\Psi = \sum_{n=0, m=0}^{\infty} |3q + nG + m\bar{q}q \rangle$$

- The probabilities for different configurations are different in different frames. The best is IMF;
- Partonic configuration lives a long time $\tau \propto E/\mu^2$;
- Fast parton components of the wave function are Lorentz-contracted $l \propto 1/p \propto 1/Ex$ while soft ones are not. Hadron as well as nuclei have the finite longitudinal size at high energies;
- Only soft (“wee”) partons interact with the target;



$$\sigma_{in}(pA) = \int d^2b \left(1 - \exp \left(- \sigma_{in}(pp) S_A(b) \right) \right)$$

$$\sigma_{in}(pp) = \sigma_{tot} - \sigma_{el} - \sigma_{diff}(\text{low mass diffraction})$$

- A. Kaidalov + Kondratyuk (1982)

→ Systematic perturbation theory with respect to G_{3p}/g ;

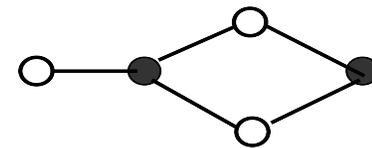
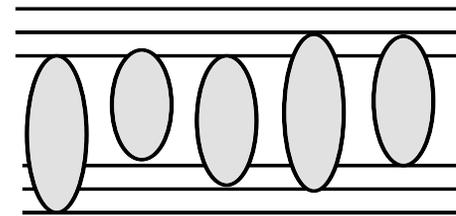
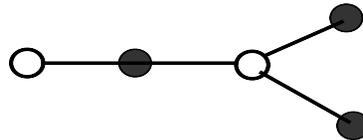
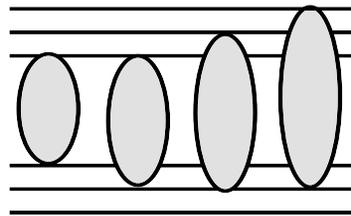
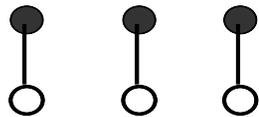
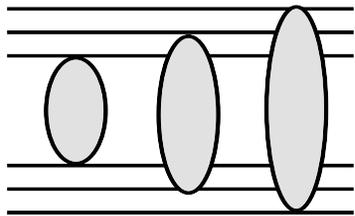
Multiparticle production in hadron(nucleus)-nucleus collision

• A. Kaidalov + Ter Martirosyan, Shabelsky + Orsay + Santiago de Compostela

- Inclusive production using the Pomeron approach;
- Multiparticle production in Quark-Gluon string model;
- Corrections to eikonal due to energy conservation;
- Heavy quark production in Quark-Gluon string model including J/Ψ suppression;

23 papers and one of the last: N. Armesto, A. B. Kaidalov, C. A. Salgado and K. Tywoniuk, "Nuclear shadowing in Glauber-Gribov theory with Q^2 -evolution," arXiv:1003.2947 [hep-ph].

Glauber-Gribov approach for nucleus - nucleus collision



Tree diagrams

Loop diagrams

- A. Kaidalov + Borerskov (1987)

$$\sigma_{tot}(A_1 A_2) = 2 \int d^2b \left(1 - \exp \left(- \frac{\sigma_{in}(pp)}{2} \int d^2b' S(\vec{b} - \vec{b}') S_A(b') \right) \right)$$

$$\sigma_{in}(pp) = \sigma_{tot}(pp) - \sigma_{el}(pp)$$

BUT

this formula is valid only if $\rho A_1^{1/3} A_2^{1/3} \sigma(pp) \approx 1$ while $\rho A_1^{1/3} \sigma(pp) \ll 1$

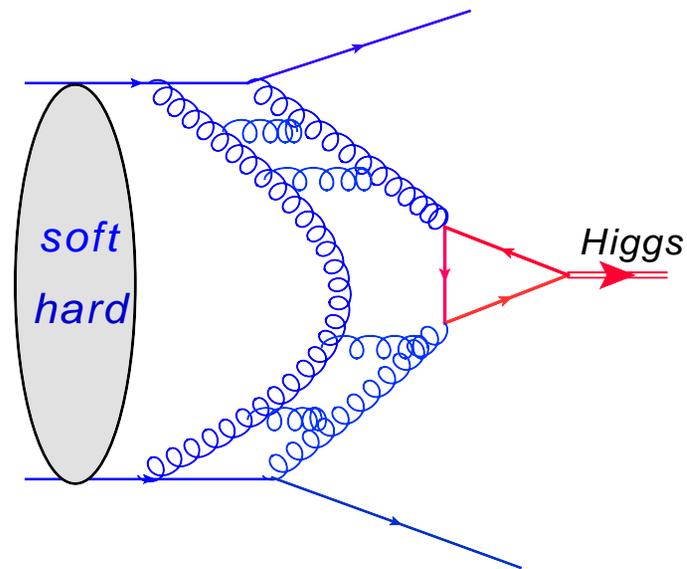
A. Kaidalov,

“Nucleus nucleus interaction dynamics
and the Glauber-Gribov approach,”

Nucl. Phys. A **525** (1991) 39.

Forward physics at LHC (RHIC, HERA)

- Central diffraction Higgs and di-jet production
(with Durham group 14 papers out of 74)

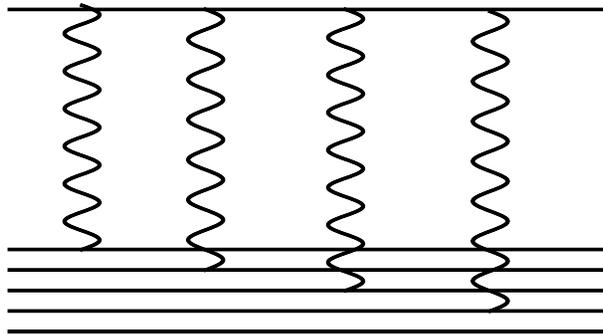


Several titles of the papers:

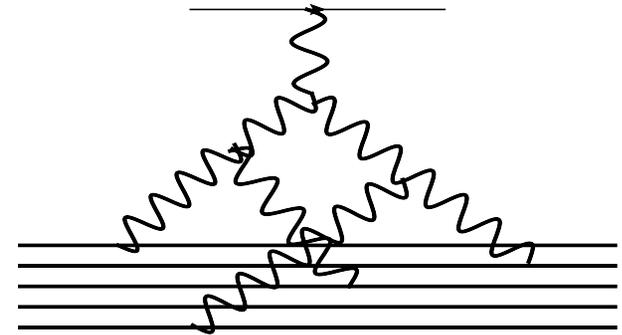
- “Factorization breaking in diffractive dijet photoproduction at HERA,”
Eur. Phys. J. C **66** (2010) 373;
- “Diffractive processes as a tool for searching for new physics”;
- “Extending the study of the Higgs sector at the LHC by proton tagging”;
- “Unitarity effects in hard diffraction at HERA”;
- “ Probabilities of rapidity gaps in high-energy interactions”;

- Interaction with nuclei

(with Santiago de Compostela and Orsay groups ; about 10 papers)



eikonal



fan diagrams

Several titles of the papers:

- “Nuclear shadowing in Glauber-Gribov theory with Q²-evolution,” arXiv:1003.2947 [hep-ph]. ;
- “Nuclear shadowing and diffraction” ;
- “Large transverse momentum suppression of π^0 's in Au + Au and d + Au collisions at $\sqrt{s} = 200$ -GeV” ;
- “Nuclear structure functions at small x from inelastic shadowing and diffraction” ;

- Heavy quarks (J/Ψ) production

(with Santiago de Compostela group ; > 10 papers)

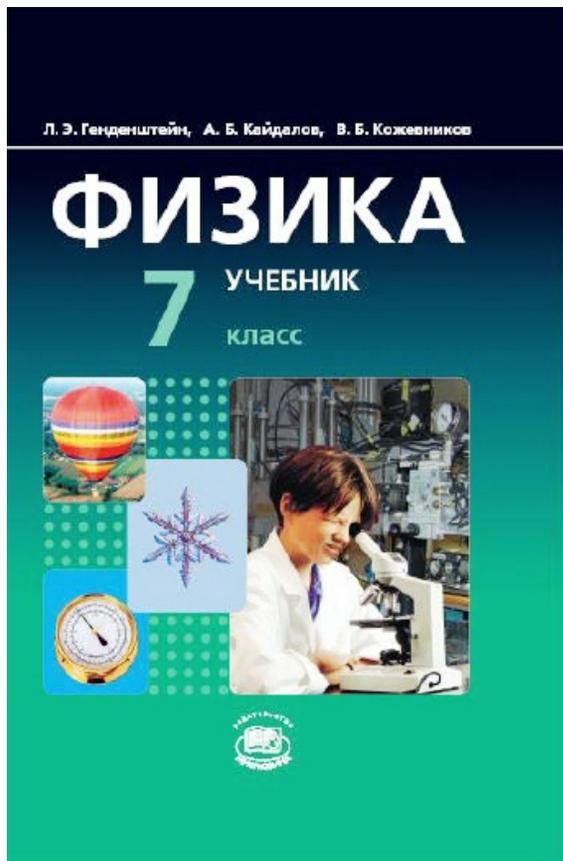
Several titles of the papers:

- “Resolving the J/Ψ RHIC puzzles at LHC,” J. Phys. G **36** (2009) 064054”;
- “Can the RHIC J/Ψ puzzle(s) be settled at LHC?”;
- “Charmonium dissociation and recombination at RHIC and LHC”;
- “ π^0 fixed p_T suppression and elliptic flow at LHC”;
- “Why is the J/ψ suppression enhanced at large transverse energy?”;

- Nucleus interaction at LHC (Alice collaboration)

More than 25 papers

Textbook: “Physics” (for 7-9 forms)



- Gendenstein, Kaidalov & Kozhevnikov

Alyosha will be missed
but not forgotten

To Alyosha's wife, Natasha, and his family:
We share your grief and we are here to
support you in anyway you need.