The Nova Herald

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Enrichment Education the SchoolNova Way

By Marina Polonskaia, Executive Director and Principal

Back in 2004, a small group of parents opened an academic enrichment program. The program has been successfully running since then. Of course, it helps that in addition to being enthusiastic and dedicated to the task, the founders are educators and scientists. Most of them went through a similar experience in their youth and value the importance of creating the right learning environment for children.

We have the luxury to look at children's education from many different angles: as scientists, we received a good education ourselves; as parents, we can see the problems from within; and as teachers and researchers, we see the gaps in what today's schools produce. We strongly believe that what you acquire in your childhood – the books you read, the music you hear, the friends you find, the sports you play, and the way you learn to think – will stay with you for the rest of your life.

Since the school opened in 2004, it has quintupled in size. We are extremely grateful for the community's strong show of support for our vision, and we are continuously looking for new ways to inspire and challenge students.

A list of annual community events offered, hosted and sponsored by SchoolNova:

- AMC 8 – American Math Contest coordinated by MAA – November
- AMC 10/12 – February
- Le Grand Concours – National French contest coordinated by AATF – February and March
- PhysicsBowl – National Physics competition coordinated by AAPT – April
- Math and Science Festival – spring
- Math Kangaroo Olympiad – March
- Advanced Problem Solving clubs – Math and Physics – every Sunday from September to May
- Science Café – 5 times a year, Saturdays

Ideal ropes, frictionless slopes and the laws of Nature

By Sasha Abanov, Physics and Math Teacher

Physics is a natural science. Its goal is to understand how Universe behaves, or in other words, to study the most fundamental laws of Nature. As we all know, Nature is complex and nothing in the real world is ideal. Then why do all physics textbooks ask you to solve problems with ideal ropes and blocks, frictionless slopes and projectile motions with no air resistance? What do all these idealizations have to do with the real world? The key idea behind this is the ***separation of scales*** and this powerful idea is behind the effectiveness of the physics approach and is important in other sciences as well.

To illustrate the idea let us consider the simplest example. One throws a ball and wants to quantitatively describe its trajectory. The motion of the ball, or more precisely the change of its motion in time, is due to various forces acting on the ball. What are those forces? The gravity force from the Earth, the air resistance force opposing the motion of the ball, the gravitational force from the Moon, … Moreover, the air resistance force, for example, is not just a force acting on the center of mass of the ball but consists of the multitude of little pushes from individual molecules colliding with the surface of the ball. The problem is complicated!

Fortunately, these forces are vastly different in their sizes, that is, they have different scales. Indeed, the Earth's gravity exerts a force of about 10 Newtons on a ball with a mass of 1 kilogram. The gravity of the Moon exerts about 3×10^{-5} Newtons, and the air resistance force for the typical velocity of a typical basketball is about 1 Newton (the latter force depends very strongly on the velocity and the size of the ball). This means that air resistance is about 10 times less important than Earth's gravity, while the Moon's gravity is about one million times smaller. This estimate makes the following approach natural. First, neglect the gravity of the Moon and the air resistance force and take into account only the gravity of the Earth. Assume that the gravity force of the Earth is uniform and constant and equal approximately $g \approx 9.8\, m/s^2$. Solve Newton's equations and obtain the standard parabolic

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By Sasha Abanov Continued from page 1

trajectory of the projectile. Then, if more accurate results are needed, take into account air resistance force and wind (important for artillery). It is hard to imagine how the gravity of the Moon could be practically important for throwing the ball example. What we saw here is how to build a model using hierarchy of scales: Earth's gravity >> air resistance >> the Moon's gravity (here the sign ">>" means "much greater"). We estimate effects of various forces, and use only the most important ones to make a model of a phenomenon and then, if needed, take into smaller forces as corrections or perturbations to the main picture.

Now we come to the main message of this essay. The hierarchy of scales of various forces can be different from example to example. For the freely falling feather, the gravity of the Moon is not important but the air resistance is of the same order of magnitude as the Earth gravity. For the motion of water in the world's oceans, the Earth's gravity is on average in balance with water pressure forces and the gravity of the Moon and the rotation of the Earth become dominant effects resulting in low and high tides. However, as long as there is a separation of scales, that is there are a few forces that are obviously stronger than others, we can neglect the latter and obtain a relatively simple but still accurate picture of the physical phenomenon at hand. Finding relevant scales and making assumptions about their relations and hierarchies is one of the most important steps in understanding physics of a particular system. Similarly, the absence of such scale separation when one has too many different forces or mechanisms of the same scale is the main obstacle in building successful quantitative physical theory.

When you see in a physics textbook sentences like "compute neglecting air resistance..." or "find assuming that the rope is ideal, that is non stretchable and massless…" you have to understand that the author of the problem is trying to help you to build a model specifying which effects can be neglected. Try to ask yourself the question: what happens if you try to take into account the air resistance or non-ideal nature of the rope? Understanding scales, making assumptions of what is important and what is not and building corresponding models is what Physics is about.

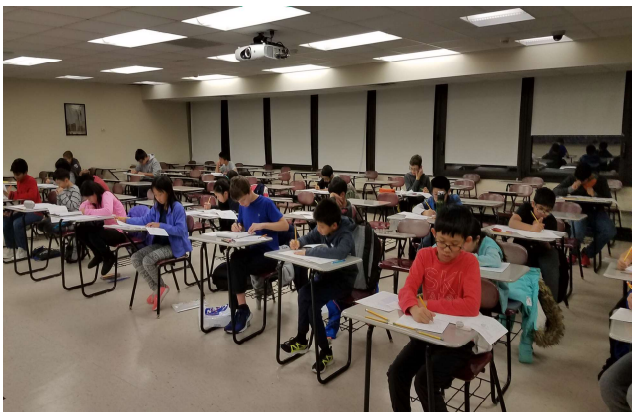
American Math Contest

By Alexander Kirillov, Math Teacher

American Mathematics Competitions is the oldest (began in 1950) and most prestigious mathematics competition for high schools and middle schools in the US. SchoolNova participates in the competition since 2005.

This year, SchoolNova once again held the American Math Contest (AMC) competition in collaboration with Stony Brook University Department of Mathematics. AMC 8 was given in November, and AMC 10/12B was offered on Feb 15, 2018. About 45 students attended each competition, less than half of them from SchoolNova. Latter contest is the first level of nationwide mathematical Olympiads, organized by the Mathematical Association of America; more than 300,000 students take it annually.

Seven students who got the best results in AMC 10/12B qualified for the next level, American Invitational Mathematics Examination (AIME) – this is our best result so far! SchoolNova will offer AIME II on March 21, and the best students from AIME will go on to USA Math Olympiad.



PhysicsBowl 2018 at SchoolNova

The 2018 exam will be given on April 11, 2018
Division I is for first-year physics students and Division II is for second-year physics students.
http://www.compadre.org/psrc/items/detail.cfm?ID=391
To register fill out the registration form:**https://goo.gl/forms/GtaWl5HzOG9rp4bk2**

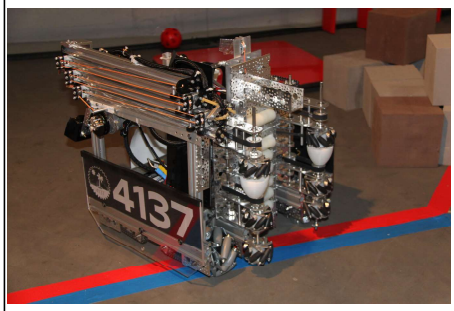
Islandbots Robotics

M. Polonskaia, continued from page 1

By Alexander Kirillov, Team coach, Math teacher

Islandbots Robotics club, now in its 10th year, continues building robots and winning competitions! For those who do not know about us, Islandbots was created by SchoolNova teachers Alexander Kirillov and Corina Mata, and many of our team members are SchoolNova students or alumni. We meet in a basement, eat pizza, and build robots to compete in First Tech Challenge (FTC) competition, a robotics competition for middle and high school students.

Last year our team advanced all the way to FTC World Championship in Saint Louis. We didn't win it, but even advancing to it is a huge achievement, placing us among the top 256 teams in the world - among over 4,500 teams. It was a lot of fun, and a great conclusion of the robotics journey for the six graduating seniors on the team, who left us to continue their study at Harvard, Carnegie Mellon, Columbia, Northeastern, and UChicago. We miss them, and they miss our team, coming back to our basement whenever they come home for vacations. Some of them even joined student robotics clubs at their universities, but tell us that it is not the same as team Islandbots.



But we recruited new team members, and the club lives on. We built new robot, for the new challenge, mastering mecanum wheels and ultrasonic sensors, Java programming and 3d printing, laser cutting and CAD design.

We took the top spot in Long Island Regional Championship, advancing to East SuperRegional (previous level competition before the World Championship), to be held in Scranton, PA on March 16-18. The team is now ready practicing and perfecting the robot. Wish us luck and follow our team progress at www.facebook.com/islandbots/ and instagram.com/islandbots4137/

In addition to regular classes, we host many science and math competitions that are free and open to the community at large, and we have recently added math and physics clubs that are free of charge for SchoolNova students. Two clubs – Advanced Math Problem Solving and Advanced Physics Problem Solving for high school students are open to the community for a nominal flat fee. They are taught by A. Kirillov, Professor in the Math Department at Stony Brook University, and S. Suchalkin, Assistant Professor in SBU's Department of Electrical and Computer Engineering. The goal of our clubs is to confront students with problems that they already have the tools to solve, but which require more creative and out-of-the-box thinking than they are used to.

Another successful experiment is our **teaching assistant** program, now in its fourth year, which gives SchoolNova graduates an inside look at our teaching methods and philosophy. Teaching is a challenge unlike any other, as it requires a deeper understanding of the subject and the ability to explain a concept in multiple ways. An approach to solving a problem may work for some students but not others, so teaching assistants must learn to visualize problems from multiple angles to tailor their explanations to every individual. By becoming TAs, SchoolNova graduates gain invaluable experience that may help them gain acceptance to a research opportunity, internship, or university in the future.

Recently, we have come up with a new, experimental idea – creating an informal setting where high school students can have informal conversations with undergraduate and graduate students at Stony Brook University, as well as postdoctoral fellows and faculty from the Departments of Mathematics and Physics and Astronomy. At this place, which we dubbed the **Science Café**, students, fellows, and faculty will gather every month or so to drink tea, talk to each other, and discuss school, their future and science. The inaugural café is being planned for April 2018. Look for more details on the SchoolNova website.

Back in 2004, the founders of SchoolNova could not have imagined what it would become 14 years later. What started out as a small group of 7 instructors teaching 4 subjects to 62 students has grown into a big enterprise with 33 teachers and almost 400 students. We now have nearly a dozen subjects to choose from, and we've expanded to offer math, science, and language competitions, math and physics clubs, teaching assistant opportunities for our graduates, and now a Science Café. I cannot fathom where we might be in another 14 years.

What's Your Story? The Secret Ingredient to a Successful College Application

By Dr. Elena Polenova

When I ask a high school student what his or her "story" is, they often look at me with complete bewilderment. After all, the Common App asks for test scores, a list of extracurricular activities, and an essay—there's no mention of a "story." But the story is the most pivotal part of any student's application, and the crux of the holistic admissions process.

What is the holistic admissions process? It's the way in which most US colleges, particularly elite universities, assess the qualities of each applicant. A holistic admissions review assumes that no single part of an application is enough to judge a student by—instead of focusing on quantitative data, like test scores or grades, balanced consideration is given to a student's background, experiences, interests, aspirations, and personality qualities. At the center of holistic admissions is the goal of recognizing and valuing the different dimensions that shape each applicant. In other words, the admissions committee is interested in identifying each student's story as unique individual.

The more relatable the story, the easier it is for admissions officers to believe in it, to be touched by it, and to present it during the admission committee's discussion. The more original and authentic the story, the better is a chance for an applicant to stand out in a pool of several thousands. As many admission officers agree, sometimes the strongest academic applicants may be seen as the least unique, and admissions officers are not moved to fight for them during a discussion. A compelling story can take a good applicant and transform them into an exceptional applicant—someone worth fighting for, in the eyes of admissions officers.

What makes a good story? My clients typically ask things like: "Can I drop orchestra in 12th grade if it means I'll have more time to volunteer at the local hospital?" "Can I quit InSTAR if I don't find it stimulating anymore?" "Do I have to take six AP courses in 11th grade?" "Will attending a summer pre-med program make me a stronger applicant?"

My answer is always the same: "It depends on how it contributes to or shapes your story."

High school students often have trouble telling their stories. Many of them feel so much pressure to excel in what's "required" that they have almost no time remaining for self-reflection—the foundation of any good story. Self-reflection isn't taught in high school. And teenagers are always asked, "Where do you want to go?" rather than, "Who are you? What do you care about?"

High school students in competitive environments often lack the confidence to tell their story—they feel as if they're "not good enough", as opposed to a unique candidate with distinctive qualities and experiences to bring to the table. In the field of psychology, the phrase "narrative identity" refers to an individual's understanding of his or her internalized and evolving life story. A narrative identity integrates "one's reconstructed past, perceived present, and imagined future." In general, knowledge of one's own narrative identity provides someone with a sense of unity and purpose in life. In the world of college admissions, a strong narrative identity translates to better essay-writing and the confident handling of interview questions—the ability to articulate your goals, interests, and the challenges you've overcome.

College and universities also have stories. Each school has a different story, image, or identity, that it wants to present to the world, and actively seeks students who understand this identity and harmonize with it. During the college search, students need to learn how to listen for each school's story—poring over a college's website, going on campus tours, and sitting in on classes will all provide elements of the story. A very perceptive student once told me that you can get a pretty good sense of a college's personality from its supplemental essay prompts!

Ideally, a student will discover six or seven schools where his or her story fits naturally with the college's narrative, and can build an application explaining why the student and school are a match, making the admissions committee's task of accepting the student much easier. Certainly, holistic admissions adds subjectivity to admissions decisions, making it difficult to explain who gets in, who doesn't, and why. But it can be truly inspiring to see a school accept a student for his or her unique story, and as a college admissions counselor, it's a constant joy to help students discover these stories, and the best ways to tell them.

What's *your* story?

Sunday March 25th, School Nova 2nd Annual Math and Science Festival

By Elena, Yakubovskaya, Math teacher

In 2017 SchoolNova hosted it's 1st Math and Science Festival at and it was a huge success! Students, parents and instructors enjoyed the atmosphere of the day and everyone found something new and existing to do.

The 2nd Math and Science Festival will take place on Sunday, March 25th at SchoolNova from 1PM to 3PM. For two hours, our school will turn into a large Math and Science playground. You may choose to go to every station for a little while, or get stuck at a single station until you've figured out the conceptual mystery that was keeping you intrigued. This year we plan to introduce new physics, chemistry and biology stations, as well as more exciting math games and activities that you may have never seen before.

Come, and bring your family and friends. Admission is free for everyone, including those who do not attend SchoolNova classes. We promise that you will be surprised and impressed with the beauty and diversity of Math and Science!

Stay tuned for more information on the SchoolNova website. If you have any questions, suggestions or want to help run a station at the Festival, please contact Elena Yakubovskaya at elena.yakub@gmail.com

This Festival will not be possible without the active participation of almost every SchoolNova teacher and TA as well as the parents of students from Math Club 1 and Math Club 2. Thank you for your help!

Students are welcome to the following events hosted by Stony Brook University:

– Public lectures at the Simons Center for Geometry and Physics are given by leading scientists coming to the campus. The lectures are announced on the Center's website http://www.scgp.stonybrook.edu/ and also by posters. In particular, public lectures in the Della Pietra lecture series are described on the Center's web site: http://scgp.stonybrook.edu/scientific/public-lectures/della-pietra-lecture-series. The next few public lectures are:
March 19, 2018, 5:30pm, "Beyond Words: What Animals Think and Feel" by Prof. Carl Safina (MacArthur Fellow, writer)
http://scgp.stonybrook.edu/archives/24992
March 26, 4:30pm, "Geometry of spacetime and mass in general relativity" by Prof. Shing-Tung Yau (Fields Medal in Mathematics, 1982)
http://scgp.stonybrook.edu/archives/25079
April 19, 2018, 5:30pm, "Exploring the Universe with Gravitational Waves: From the Big Bang to Black Holes" by Prof. Kip Thorne (Nobel Prize in Physics, 2017)
http://scgp.stonybrook.edu/archives/25020

– Lectures on Astronomy, Physics, Geosciences, Ecology and Evolution are given almost every Friday night during school year. These lectures are targeted to the general audience and are given by faculty of the University on topics related to their research. Schedules and information can be found at: http://www.physics.sunysb.edu/Physics/WorldsOfPhysics/2017-18/

– SchoolNova is hosting several national math, physics, and language competitions. Links to these and other activities recommended by SchoolNova can be found on the SchoolNova web page: **http://schoolnova.org/nova/activities**

Read. Be Inspired. Write Back.

By Kara Palumbo, English Teacher

This has been an exciting year for SchoolNova's Advanced English classes. Every year our Advanced English students are enrolled in writing competitions. Advanced English A students competed in The Library of Congress's letter writing competition Letters About Literature. For this competition, students had to write a letter to an author whose work inspired them. After studying model texts, students drafted, edited, and submitted their letters to The Library of Congress. Since the submission of their letters, Advanced English A has been busy analyzing classical texts such as "The Tell-Tale-Heart," "The Sniper," and "The Monkey's Paw." This year's students are all active participants in class and have kept me busy with their inquisitive minds. Advanced English B students were also enrolled in a writing competition. Students submitted their work to the Scholastic's Art and Writing contest. For the second year in a row, SchoolNova is proud to announce that three of our students received awards! Srivaths Ravva received Honorable Mention for his critical essay "Robots: Helpful or Harmful?" Abhiram Marisetti received Honorable Mention as well for his, flash fiction piece "The Escaped Betrayal." And Lillian Zhi will be receiving the Silver Key award for her flash fiction piece "Scarred." **The Silver Key** is awarded for stand out-works that are submitted to local programs, which demonstrate exceptional ability. Congratulations to all these students for their hard work and for their dedication to the writing process. Advanced English B students are currently working on the skills necessary for ACT and SAT exams. Some of these students may be a couple of years away from taking these exams. However, understanding the writing requirements for exams such as these will provide them with the complex skills needed to advance in their ELA classes.

Excerpt from "Scarred"
By Lillian Zhi, Advanced English B (8th grade)

I woke to the dim sunlight of the early morning, and the howling of the wind. I buried my face into my pillow and groaned. I lay in bed, covered by my pale green comforter. I looked up at the blank white ceiling above me, swinging my legs over the side of my bed, and flinching as my bare feet hit the hard, cold floor. I walked over to the mirror that hung above my dresser and stared at it. A girl with wide, hazel eyes and chocolate brown hair. Pretty average. But her defining feature was the jagged line of swollen tissue that reached from her earlobe to her chin, tracing her jawline, a scar identical to mine. Her head moved to the side, so she could inspect it better, and smirked. Entranced by her, I mirrored the actions. Suddenly, the room behind her goes dark, and the only thing I could see was the evil glint in her eyes as she raised a knife in her right hand, and reached through the mirror, laughing at my terror…

Excerpt from Letters About Literature
By Andrew Morgan, Advanced English A (6th grade)

My dad died of Diabetes five years ago when I was only six. He was my best friend and I loved him dearly. […] I found your book, *Timescape*, in our class library. I read the blurb on the back and it sparked deep thoughts in my mind. I thought about it from the realistic standpoint. I thought about it with an obscure approach. In the end, I figured it was all the same. While I was reading your book, yes, it did bring back memories. But more importantly, it helped me resolve my pain. It helped me stay strong and fight back. This book also showed me how my thoughts have led me to think about my future, or even how others think about theirs. Finally, I acknowledged how it feels for others, as well as myself, to lose a loved one. That day, I started an adventure.

Excerpt from "Robots: Helpful or Harmful?"
By Srivaths Ravva

Last, and maybe even least, robots are taking away jobs. Not just some industrial robots that speed up the process of manufacturing things, but robots that deliver things, robots at fast food restaurants, robots at bank with money transactions, robots at hospitals, and even online shopping. Delivery men will not have to go around driving big buses, there wouldn't be any friendly human cashiers, no understanding human bankers, and no more "Hi welcome to Amazon shopping how may I help you today?" but "This is Amazon online shopping. Do you require any help?" There would even be robots at hospitals, like the "DaVinci Robot." People would probably get terrified just looking at the several-limbed creature. The robot could malfunction, and even kill people accidentally. There would be less and less human connections and interactions as robots take over jobs. Not just relations, but the economy will deprive. Many people will live poorly, either buying these tremendously expensive robots, or just losing their jobs.

How Can I Help SchoolNova?

SchoolNova at Stony Brook is a nonprofit 501(c)(3) tax-exempt organization and is qualified to receive tax-deductible bequests, devises, transfers or gifts. Contributions from individuals, foundations and corporations are welcome. You can donate through the PayPal Giving Fund (no fee), using PayPal Donate Button (fee is charged), by sending us a check or through Fidelity Investments. (School's account # Z47924238).

If you would like to make a charitable donation to the Russian Theater studio "Dragonfly" or to Islandbots Robotics team, please, specify by writing us an email.info@schoolnova.org

Physics Clubs

By Sergey Suchalkin and Alexander Abanov

This year we have started two physics problem solving clubs: regular and advanced. The main idea was to get a deeper understanding of physics through solving physics problems. Instead of listening to teachers' explanations of physics concepts and laws students would try to *apply* those laws to solve selected problems. Learning Physics through solving problems is a known approach. There exist few competitions designed to raise students' interest to Physics and to encourage them to develop problem-solving skills. SchoolNova clubs would also work on preparing students to such competitions, e.g., for the PhysicsBowl Contest. Both clubs are free to students who are already enrolled into SchoolNova and are open to other students at nominal cost.

Both regular and advanced Physics Clubs worked successfully since the beginning of the year. We solved various problems in mechanics, electrical circuits and thermal physics. Soon we will be able to gauge our problem solving skills as we participate in the PhysicsBowl 2018 in the middle of April 2018.

It seems that the main difficulty in running clubs is the very different level of students' preparation. The Physics is usually studied only in the last couple of years of high school and students coming to clubs typically did not have any regular classes of physics before that. At this point we designed the clubs in such a way that the regular physics club level would roughly correspond to the level of the Advanced Placement (AP) Physics B or Physics Bowl Level 1, while the advanced physics club would be close to AP Physics C of Physics Bowl Level 2. The crucial thing is to get a critical mass of students who would know some basics and have a similar level of preparation. If you are interested in learning how to solve physics problems (and you should!), please, spread the word out. The more club participants we have next year the more successful this program will be.

Good Luck, "Dragonfly"

By Nadezhda Shavarina

2017 season of "Dragonfly" theater was really intense: our usual turmoil of the rehearsals, endless discussions on the decorations and costumes, role distribution, and excitement right before a performance followed by relief and satisfaction after. With our younger group of actors we released the sparkling musical "Masha & Vitya Versus Wild Guitars" and the thrilling "Kalle-Detective". The older kids played in our cheerful performance based on A. Chekhov's short stories. All this culminated in Washington, D.C. at the International Festival of Russian-Speaking Children's and Youth Theaters, where we performed "Kalle-Detective" once again. Lia Nekrasov received the "Best actress" award – one of the major festival prizes.

The current season seems to be as dense as the previous one. We have performed "The Cat Who Walked by Herself" by Rudyard Kipling. The play was written by Nonna Slepakova and adapted for our theater by professional playwright Julia Damsker. Julia is helping us with the new release, which is coming: "Harmful Advice" by G. Oster. And, as in recent years, we are looking forward to performing in Washington. Please wish us good luck!

Greetings from the North Pole!

By Snegurochka

At SchoolNova's fourteenth annual Holiday Party, Ded Moroz and I had the honor of spending New Year with the most wonderful group of children in the world!

You wouldn't believe how long the journey is, all the way from our frozen home in North Pole. Luckily, Grandfather's surefooted trio of horses wasted no time in bringing us to you. The moment we heard we were invited to the Holiday celebration, it was off to the troika and we were on our way, bringing gifts for all of the children!

When we arrived, you first treated us to a spectacular musical theater production - "The Cat That Walked All By Herself." We were amazed as the children sang and danced in beautiful costumes, performing a variation on Rudyard Kipling's classic fantasy tale.

After the show, Ded Moroz and I led the children in songs, games, and dancing around the New Year's tree. All of the families had brought delicious food to share, and so we ate and drank until we could hardly move, let alone dance! Then it was time to give out the presents and, all too soon, to return home to the North Pole.

Until next year, children! I can't wait to see you all again, the next time we meet for fun, food, and friends around the New Year's tree.

Other activities and opportunities for children

SchoolNova faculty and students are part of other activities for elementary, middle and high school students.

- Islandbots Robotics, Coaches – Alexander Kirillov and Corina Mata
- Russian Theater studio "Dragonfly", Director – Nadezhda Shavarina
- Science summer camp – SigmaCamp, Director – Elena Yakubovskaya

Many of SchoolNova's faculty and students also come to SigmaCamp, and we highly recommend it to everyone who loves math and sciences! We are happy to announce that registration for SigmaCamp 2018 is now open.
If you are between 12-16 years old and want to spend a week in August learning about neural nets, building and programming robots, extracting and sequencing DNA, creating your own cyborg, by tapping into the nervous system of a cockroach, playing mafia and 'escape the room' or doing all of the above, under the supervision of university professors and researchers, in the company of likely-minded students and counselors, coming from all over the world, then go to http://sigmacamp.org/2018 and apply!

Thank you for your support!

We would like to thank everyone who was generous enough to donate time, money and corporate stocks to SchoolNova! We sincerely appreciate your support and help!

Special thanks to the Simons Center for Geometry and Physics and to the Departments of Physics & Astronomy and Mathematics for providing space for SchoolNova's competitions and special events.