



# The **28<sup>th</sup>** International Young Physicists' Tournament

**NAKHONRATCHASIMA THAILAND**



**27<sup>th</sup> June - 4<sup>th</sup> July 2015**  
Suranaree University of Technology

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## Message from Rector of Suranaree University of Technology

I would first of all like to extend a special welcome to our international guests to Suranaree University of Technology.

When I learned of the news that the 28<sup>th</sup> International Young Physicists' Tournament was going to be held in Suranaree University of Technology I was very pleased. As a person who has been involved in Physics education, I am very proud that we are the first to have hosted the IYPT in Thailand. To be more specific, Korat. Korat holds a very special place in my heart in that, the most vivid of my boyhood memories live here. An international competition of this magnitude held in its environs only goes a long way to enrich these cherished memories. It is my wish that this event will inspire younger ones of this generation to embark on a path of science that few are courageous enough to tread.

Because I can see how stimulating the tournament is for Physics learning, I foresee the impact the tournament is going to have on how science competitions will be organized from now on. Talented persons in science cannot possibly be measured by their high score earned from the pencil-and-paper test alone. Instead, it is the evidence based reasoning and higher-order cognitive skills that the competitions should encourage. And here, as far as I understand, in the 28<sup>th</sup> IYPT, the most creative Physics problem solvers are going to be announced.

I am very happy to hear from the Dean of the Institute of Science that some of the fights will be open to people from interested schools. You provide them with the rare beautiful opportunity to get inspired so closely to the talented students in action. For all the nice things that are going to happen in SUT this week, I would like to express my deepest thanks to the IYPT members, especially to Evgeny Yunosov, the founder of IYPT. The tournament you created has added so much joy into the search for physics understanding in the competition. I am sure the tournament will serve as a powerful motivation for many students as you want it to be. I also would like to thank the organizing committee who have always been determined to work at their best to organize the 28<sup>th</sup> IYPT.

At last, I would like to wish you a wonderful tournament.

**Prasart Seubka, Rector**

Suranaree University of Technology



## Message from Office of the Basic Education Commission

The main mission of the Office of the Basic Education Commission is to provide and promote the pre-university education for the Thai youth in order to develop human resource for the country. The inadequacy of quality human resource in science and technology in Thailand has long been recognized. Many of our projects attempt to take part in problem alleviation. We perceived the IYPT as one of the ways to get Thai students to become more interested in science. We believe, the improvement of science learning management can be encouraged in those who have experience with IYPT. Teaching based on problem solving improves scientific operation skills. Therefore we have been giving financial support to science schools to participate in the Thai Young Physicists' Tournament or TYPT. Every year, we provide training course on how to conduct physics research project. And we plan to support the TYPT winning team to observe the 29<sup>th</sup> IYPT in Russia next year.

The organization of the 28<sup>th</sup> IYPT in Thailand is really special. By seeing competition in the physics world so closely, teachers and students will be so much inspired. It is going to be an eye-opening experience. The essence of science will be revealed to our young generation. In addition to the application of knowledge to solve the problems, the tournament will show that the best performance stems from the most effective utilization of knowledge-intensive team work. This aspect is truly important when it comes to human resource development. We want our future generations to be able to cooperate with others for the common important goal.

I would like to congratulate all of you on taking part in such a great tournament and wish you success.

**Kamol Rodklai**

Secretary - General of the Basic Education Commission



## Message from President of IPST

On behalf of the Institute for The Promotion of Teaching Science and Technology (IPST), it gives me great pleasure to welcome you all as participants to this 28<sup>th</sup> International Young Physicists' Tournament (IYPT 2015) and to Nakhon Ratchasima Province.

One of IPST objectives is to develop and promote science, mathematics and technology talents as well as outstanding and talented science, mathematics and technology teachers. IPST has tried to cultivate our youth's passion and curiosity in science, mathematics and technology to prepare them to become good scientists and great teachers. I believe that this competition is the best model to cultivate their logical, critical and scientific thinking. In addition, this tournament is a meeting place of the like minds and as such it provides the participants with valuable opportunities for exchange of knowledge and ideas.

Therefore, it is indeed a privilege for The Institute for the Promotion of Teaching Science and Technology to co-host the 28<sup>th</sup> International Young Physicists' Tournament for the very first time in Thailand. IPST hopes that the IYPT 2015, on one hand, will not only enhance the academic atmosphere but also forge stronger international relations and better understanding among the countries. On the other hand, it will help the participating young people to realize their own talents and stimulate them to go the extra mile. Eventually, it is all for the benefits of education development and any other scientific-based learning and undertakings.

Last but not least, IPST sincerely hopes that you will all take back with you fond memories of this event and either new or stronger friendship. Once again, welcome to the 28<sup>th</sup> International Young Physicists' Tournament 2015 in Nakhon Ratchasima, Thailand !

**Pornpun Waitayangkoon**, President  
Institute for the Promotion of Teaching Science and Technology



## Message from Chair of LOC

Dear friends,

Thais have been interested in the IYPT since the year 2008, when Dr.Thongchai Chewpreecha, who was the principal of Mahidol Wittayanusorn School (MWITS), led a team to observe the 21<sup>st</sup> IYPT in Croatia.The following year they formed a team from MWITS to represent Thailand to compete in the 22<sup>nd</sup> IYPT in China. In that same year, the Institute for the Promotion of Teaching Science and Technology (IPST) was introduced to the IYPT and a group of representatives from the IPST leading by Dr. Pornpun Waitayangkoon, the director of the IPST, went to observe the 22<sup>nd</sup> IYPT in China. They immediately realized that this is another stage arena for training young people to be our future great physicists.The IPST then helped to set up a team to observe the 23<sup>rd</sup> IYPT in Vienna.That was my first experience with the IYPT as I was part of the observing team. After the observing team returned to Thailand we had a discussion and agreed to propose to the IPST that Thailand should send a team to join the tournament. The IPST has financially supported the Thailand team to compete in the IYPT since the 24<sup>th</sup> IYPT and is now an International Member Organization (IMO) of the IYPT of Thailand.

I love the idea of Physics fights in the IYPT in which the problems are viewed from different angles and solved in an open way resembling the process of doing research. The IYPT is really good arena for training young people to have many great skills, not just learning how to solve or deal with the problem in physics, but also how to do research, collect and interpret data, prepare presentation, discuss, and debate. Many students who have passed this stage went on to study physics for their higher education. Many teachers and faculties whom I met during the IYPT have told me similar things that the IYPT has made them stop being teachers but being instructors instead.



The idea of having Thailand to be the host to organize the IYPT was originated while we were attending the 23<sup>rd</sup> IYPT in Iran. A reason behind this idea was that we would like to promote the IYPT to Thai physics teachers and to the organizations concerning with the basics educations. The best way to do this is to host the IYPT in Thailand and invite them to observe the tournament. The news that the tournament was going to be organized here in Thailand has captured the interest of many schools. The Basic Education Commission of Thailand (OBEC) has financially supported teachers and students from 207 schools all over Thailand to observe the IYPT 2015. We also invited teachers and students in the areas around Suranaree University of Technology (SUT) to attend and observe the IYPT 2015. This will help them to gain an experience in the international competition. A team of faculties leading by Dr.Khanchai Khosonthongkee, who has experiences in the past IYPT, has set up a workshop concerning with the tournament for training the teachers in parallel with the IYPT 2015. So far it has been very successful to introduce similar tournament in Thailand. We now have the Thai Young Physicists' Tournament

or TYPT supported by the OBEC. TYPT is the national tournament conducted in Thai.

In 2012, we proposed to host the IYPT in the year 2015 at the 25<sup>th</sup> IYPT during the IOC meeting at Bad Saugua in Germany. We are here now. Twenty eight countries participate in the tournament this year. I would like to express my gratitude to SUT and the two co-hosts, the IPST and the OBEC, and to our sponsors for their generous support. It is indeed our great pleasure to welcome you all to the 28<sup>th</sup> International Young Physicists' Tournament in Thailand, at Suranaree University of Technology. I hope you will enjoy not only the tournament itself but also the food, the culture of the Thai people in this area, and the natural resort as we will provide or show you during the excursion or reception while you are here. I strongly hope that the 28<sup>th</sup> IYPT will be a memorable tournament for all of us.

**Prapun Manyum**

Chair of the Local Organizing Committee, 28<sup>th</sup> IYPT 2015  
Dean of the Institute of Science,  
Suranaree University of Technology

## Message from President of IYPT

It is with great pleasure that I welcome you to the 28th International Young Physicists' Tournament in Thailand.

It is wonderful to see teams from North and South America, Africa, Europe, Oceania, Asia and the Middle East come together here in Nakhon Rachatsima and talk Physics. Given the troubles that beset various parts of our world it is so important that the youth of our nations are able to meet in this way. I pay tribute to the vision of our Founder, Evgeny Yusonov, in creating a physics competition that celebrates problem solving and international communication. I encourage all here to take the opportunity to develop new friendships in the unique environment of IYPT. Continue the communication into the future.

This year marks my seventeenth tournament and I still feel the anticipation of a new IYPT. It has been a privilege to be see so many great physics fights over the years and each time I learn something new. Every year seventeen new problems will be presented and each stage of each round will bring something interesting to see. The time before the physics fights get underway is also filled with keen anticipation for our competitors. They have been battling to put the finishing touches to their solutions of the seventeen complex problems that have been a major part of their lives for much of the last year. They now face the challenge of presenting and debating their work. They have learnt much but will continue to learn here.

I would like to thank the LOC in Thailand for volunteering to host this event here in Nakhon Rachatsima. We are fortunate to be able to visit such an interesting part of the world and I look forward to a memorable experience.

Best wishes,

**Alan Allinson**  
President IYPT





## Message from Founder of IYPT

Dear friends,

Since 1988, the line of annual IYPTs connects many amazing places on various continents. I am thrilled that the 28<sup>th</sup> IYPT takes place on the campus of Suranaree University of Technology. Nakhon Ratchasima is a place which is especially attractive for physicists as it houses Siam Photon Source, the only synchrotron light facility in the region.

I would like to extend my greetings to all team members and captains, team leaders, independent jurors, experts, volunteers, Physics Fight administrators, as well as to guests of honor, and distinguished observers. I greet and thank the local organizers, Dean Prof Dr Prapun Manyum and Rector Prof Dr Prasart Suebka, for their kind hospitality that will certainly ensure a memorable tournament in the unique country of Thailand. I know that their efforts are supported by prominent local sponsors as well as the Institute for the Promotion of Teaching Science and Technology in Bangkok, and the Office of the Basic Education Commission of Thailand.

During its 28 years of existence, the IYPT has brought together a vast community of former participants, enthusiasts, and friends. Those who consider themselves to be part of the IYPT will soon realize that the tournament has become an integral part of their lives.

Among the special people who devote their passion to the IYPT is our President, Mr Alan Allinson. I shake Alan's hand for persistence and resourcefulness in hosting the 17<sup>th</sup> IYPT in Australia when the number of competing countries surged but finances plunged. It was Alan who handled this situation heroically. Alan went on to become the IYPT President after the 21<sup>st</sup> IYPT and has been advocating for the IYPT throughout his two distinguished terms. I would like to say thank you to Alan for his very special contributions into the IYPT. Today we express our gratitude for the progress under his watch.

For an organization as big and long-running as IYPT, financial stability and streamlined procedures is not an empty phrase. The IYPT Treasurer, Dr Ilya Martchenko,



makes sure that the IYPT feels the soil beneath the feet, and the financial interaction between the LOC and the IYPT runs like a well-oiled machine. During his tenure, Ilya changed the way we understand the financial independence and resilience against the yearly fluctuations and challenges of funding for the IYPT's core needs.

It is my pleasure to thank the Secretary General of the IYPT, Dr Martin Plesch, for his special devotion to the competition. He identifies tasks that require evolving solutions and has secured a smooth, wise, and rigorous juror selection in his committee with Dr Assen Kyuldjiev and Mr Timotheus Hell. It has now been for second time when Martin took over a responsible role of the LOC inspector who arrives at the IYPT venue and checks that all is ready on the spot.

Of course, I am grateful to Dr Georg Hofferek and Mr Timotheus Hell. Their honorable NEWTOON oversees results falling as apples into our hands, while their Mme CURIE irradiates the organizers with a steady flux of registration details.

I see the vector of development for the IYPT not only in increasing the quality of problems and grading, but also in ensuring ultimate financial independence and proactively attracting the countries that are not yet involved. It seems that the sibling competition of the IYPT, the IYNT, can help in fulfilling this goal. The IYNT is a competition for younger students who inevitably come of age and become determined to enter the IYPT. Two countries from the IYNT community, Serbia and Turkey, were pre-registered for the 28<sup>th</sup> IYPT and I am sure will successfully enter the 29<sup>th</sup> IYPT.

We regret if countries skip an IYPT due to financial reasons. We are however always happy if a country returns back, sometimes after a lengthy hiatus. I welcome back Kenya who last time entered the 25<sup>th</sup> IYPT. I would especially like to welcome back the US, the nation that was first pre-registered by Prof Dr Jack Wilson to compete at the 3rd IYPT in Moscow and last time took part in the 20<sup>th</sup> IYPT. The US finally returns due to a surprising and fortunate contact of Mr Jay Jennings with the official IYPT account on Twitter.

Besides the Physics Fights, one of the most remarkable features of any IYPT is its problems. Such problems play a vital role in securing the reputation of the IYPT and have allowed the IYPT to survive against all the odds when the participant community was only attracted by the true values of the tournament and its problems, rather than any international distinctions. I would like to thank all contributors of the amazing problems and I would like to applaud the committee of Mr John Balcombe, Mr Samuel Byland, and Dr Ilya Martchenko for their diligence and creativity leading to the selection of a truly magic and original list of 17 problems year over year. These problems bolster the IYPT posture and allow attracting the young and talented young physicists.

I was recently surprised to discover that in 1989 I advocated for a knowledge bank of the IYPT to preserve its expertise for posterity. This derelict idea eventually became vibrant reality. Even my modest opinion, of which I have long forgotten, was eventually found in this bank of knowledge and put on the table. Today, anybody on the Internet can consult the whole catalogued history of

the IYPT and find a meticulously collected IYPT library and archive of knowledge. It comes as a gift to the readers who are lucky to use it. The archive allows us seeing the IYPT as a whole picture rather than a short-lived mosaic. I applaud Ilya and his colleagues for their enthusiasm and especially for the materials and promotional videos that position the IYPT as a global organization, and not as a disconnected mosaic of medals, rules, and venues.

I extend my gratitude to all other members of the IYPT Executive Committee. We are fortunate to have this young and devoted body in the movement. It is their work allowing the competition maintain the top-notch quality standard. Thanks to them, the IYPT can build on its history and is now better positioned for the future.

To overcome new challenges and stand stronger than David fighting Goliath, the IYPT will require the energy, reputation and dedication of future supporters, friends, and leaders. After the 4<sup>th</sup> IYPT, the tournament lost its initial pool of sponsorship, and the entire financial infrastructure of the IYPT had to be reinvented to ensure that it survives. I am sure that many of you would continue standing together with the IYPT in your future careers and continue

contributing to a strong, efficient, and independent IYPT. The 1<sup>st</sup> International Young Physicists' Tournament saw 31 teams from 2 Eastern European nations and 14 Soviet constituent republics. The 25<sup>th</sup> IYPT, the 27<sup>th</sup> IYPT (and hopefully the 28<sup>th</sup> IYPT) were to see 28 teams from different nations. I would soon love to see these two records beaten and no less than 32 teams at the next IYPT.

Today, I hope you will all enjoy your time in Nakhon Ratchasima. I wish that the IYPT becomes experience of a lifetime for all competitors. I hope that your experiences at the IYPT become the energy that will drive you to accomplish your true goals in life.

I hope the IYPT will help you to nurture your interests in science and foster confidence in your abilities that has brought you to the International Young Physicists' Tournament.

“You can fight physics, but physics always wins”, a joke says. Let me wish you good luck.

**Evgeny Yunosov**

Founder of IYPT

# Principal Guest Speaker,

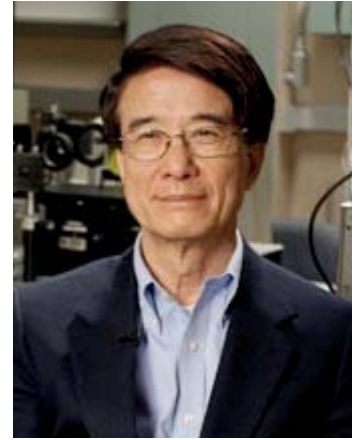
Our honorary speaker is Prof. Paul C. W. Chu, the current Executive Director, Texas Center for Superconductivity at the University of Houston and the Founding Director, Institute for Advanced Study, Hong Kong University of Science and Technology (HKUST). He also served as the President of HKUST (2001-2009).

His research highlights are the early discovery of stable superconductivity at 93 K ( $-180^{\circ}\text{C}$ ) in YBCO, above the liquid nitrogen temperature in 1987 and the record high temperature of 164 K ( $-109^{\circ}\text{C}$ ) in Hg-1223 in 1993. Presently Prof. Chu has actively engaged in both basic research and technological applications of high temperature superconducting and related materials. Over 550 papers of his research work has been published.

He is a member of many academies of sciences and engineering in U.S., China, Taiwan and Russia. His distinguish awards include the National Medal of Science, the International Prize for New Materials, the Comstock Award, the Texas Instruments' Founders' Prize, the John Fritz Medal, and the Freedom Foundation National Award.

## Honorary Speaker

Paul C. W. Chu



# Alan Allinson and the IYPT

A documentary filmed at the 11th IYPT in Donaueschingen, Germany in June 1998 shows frames of a smiling and curious person who arrived at the IYPT for the first time (Figure 1.)

His name was Alan Allinson, and his team of Brisbane Girls Grammar School entered the competition that still featured Semi-Finals, a grading system from 2 to 5+, and a peculiar ranking to determine the winners. Albeit Australia did not reach a top spot in 1998, Alan has become truly captivated by the IYPT and has been involved with it ever since.



Figure 1. Alan Allinson at the 11th IYPT in Donaueschingen, Germany in June 1998

In his own words, “When Germany first hosted IYPT in 1998, with the participation of the teams from Australia and Mexico, it was the first time nations outside Europe were represented. That was my first experience of IYPT and the start of an obsession that has created a revolution in my approach to physics teaching.”

Australia soon reached the Finals at the 14<sup>th</sup> IYPT 2001 in Espoo when I was a student participant myself. I remember a mix of curiosity and astonishment, and how I and my team were impressed by the performances of the Finalists, some of whom still used overhead projectors and transparencies as visual aids.

“Australia’s involvement in the IYPT is due to energy and vision of Alan Allinson, the Head of Physics at Brisbane Girls Grammar School”, wrote William MacGillivray in a 2004 article about the tournament in the country. Alan was instrumental in introducing the IYPT in Australia and extending the

reach of our tournament into the Southern hemisphere. The national IYPT Australia Challenge was held for the first time in 2003, and already in 2004 attracted a total of 12 teams from South East Queensland.

It was in October 2003 in Modra, Slovakia when the host of the 17th IYPT was finally confirmed to be Brisbane (Figure 2.) “The survival of IYPT depends totally on the enthusiasm and hard work of our hosts”, Gunnar Tibell, the late President of the IYPT, wrote in 2004. The IYPT 2004 was an enormous challenge for Alan yet a fantastic experience for 26 teams from a record of 24 countries in June 2004.

Alan became President of the IYPT in May 2008, earning compelling 18 votes out of 22. He continued serving in this responsible and unifying role after 2012 when his position was determined by acclamation. Many of us have reflected on what makes Alan a great chairman of the IYPT. Alan’s large-hearted optimism and understanding of the IYPT’s true values have won friends from every



Figure 2. František Kundracik, Masno Ginting, Gunnar Tibell, Ivan Košinár, Andrzej Nadolny and Vladimir Kulinskii (left to right) listen to the presentation of the 17th IYPT 2014 in Modra, Slovakia in October 2003. The slide reads, “Brisbane – a long way to travel!”

participant nation. Many of us have been warmed by his generosity.

As Alan Allinson steps down from the position of the IYPT President in 2015, I would like to thank him for guiding the IYPT through the seven years of growth and of multiple challenges to secure host organizations. Some six years ago, Alan’s emails were forwarded to me to explain that “on a sadder note, our host and our reserve host are now both unable to stage”. The eventual hosts of the IYPT 2010, 2011, and 2012 were last-minute saviors, while the original hosts

were replaced, sometimes more than once, and sometimes because we lost beloved colleagues who had been attending the tournament since the 1st IYPT 1988 in Moscow. In face of uncertainties and setbacks, Alan has always been confident in what I call the “continuity” of the IYPT.

As we discussed the stability and long-term financial infrastructure of the IYPT, Alan’s point has repeatedly been in using our funding to meet our core business of ensuring an IYPT takes place each year, and that no disruptive challenge would jeopardize any future IYPT. Alan’s decisions are rooted in his firm belief that if the IYPT is to be a truly World competition, it must grow. He envisions that the IYPT must be stronger, attract more nations into the movement, and grow close to 40 nations in the next few years. Therein lies the true explanation of Alan’s concerns about the IYPT’s profile and status, recruitment, problem selection, affordable

registration fees, and adequate rooming, nationally and internationally.

Following the IYPT 2015, Alan will have more spare time for family and work at school, and hopefully be receiving a smaller number of anxious emails and urgent requests to give his input on something terribly wrong.

Luckily for the tournament, Alan will stay together with the IYPT, and we can fully rely on his experience, knowledge and optimism ever and ever again.

Let us all be encouraged to foster the spirit of friendship and exploration of new frontiers that Alan promotes. We look forward to many exciting future IYPTs with our enthusiastic colleague, juror, chairperson, problem author, and truly inspiring friend from Brisbane.

Dr Ilya Martchenko  
ilya.martchenko@iypt.org

# Suranaree University of Technology



Suranaree University of Technology (SUT) was established as the public autonomous university, outside the civil service system. Based upon the high autonomy, flexibility, and efficiency principles, the university maintains centralized services and coordinated missions administrative paradigm. While some activities are privatized, most operations could be decided at the university level while minimizing as much as needed man oeuvre from external bodies. These result in the organization and workflow development that most suits university affairs, and accordingly the most optimal resources utilization.



SUT is the university specializing in science and technology. It has been established in response to the needs for producing and developing advanced human resources in the areas of science and technology, which is crucial for national development. It has founded the centers of excellence in many areas, most notable of which are those specializing in Physics, Chemistry, Biochemistry, Molecular Biology, Agriculture, Health Science and Engineering. The university aims to adapt, transfer and develop technology as well as a body of knowledge, as it has declared itself as the “society companion university”.

SUT has the cooperative education system which is the role model innovation in the Thai higher education spectrum. It is required that students go out and work fulltime in the workplace both within and outside the country. Therefore, the graduates from SUT have had a high achievement in starting their employment in both public and private organizations, in and outside the country.

Moving forward into the 3<sup>rd</sup> decade, SUT aspires to be a pillar of Thailand, the university with innovations and academic excellence, reconciling with the international community.

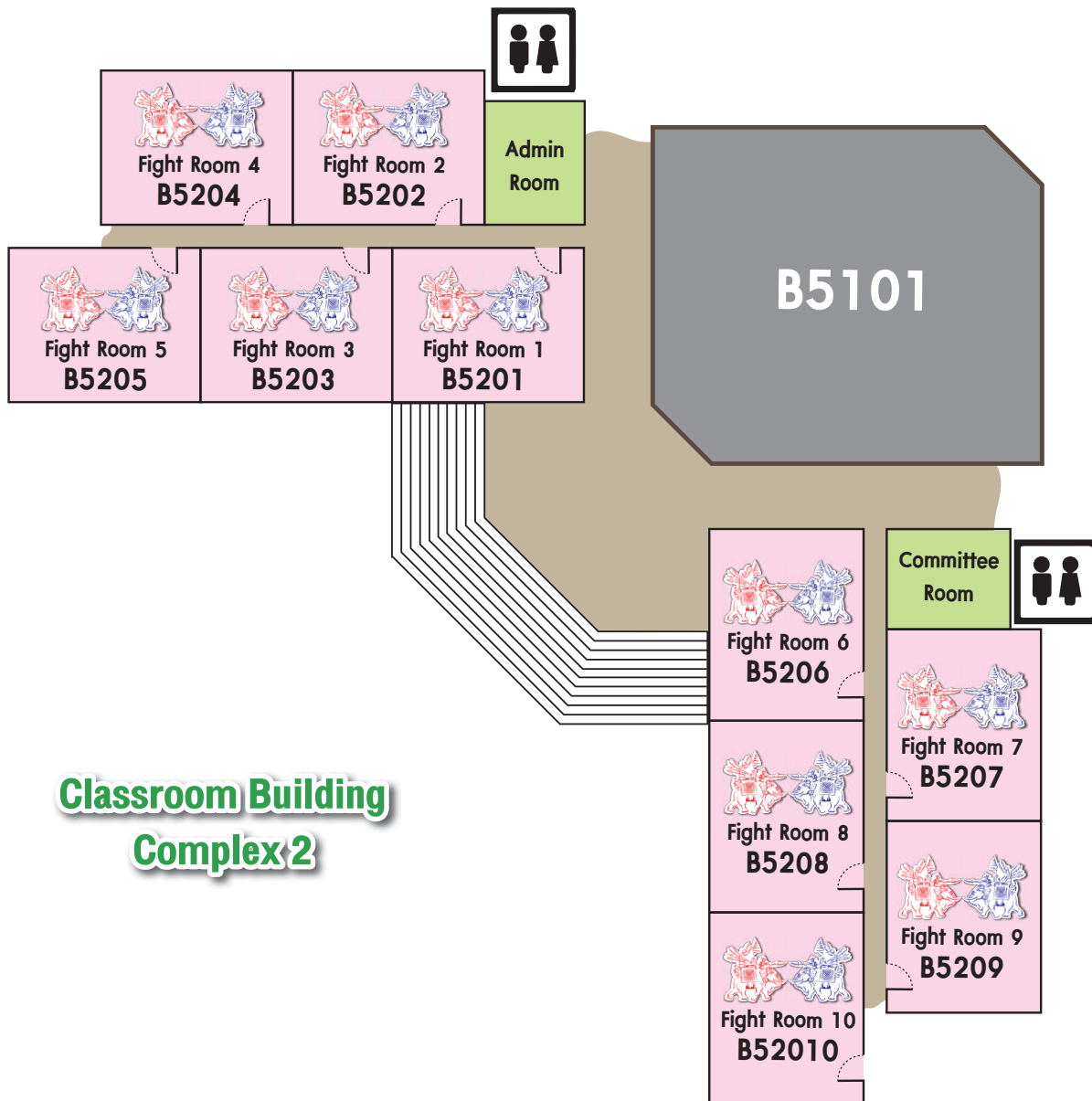


# Map of SUT



# Floor Plans

## Suranaree University of Technology



**Classroom Building  
Complex 2**

# Schedule for IYPT 2015

Suranaree University of Technology, NakhonRatchasima, Thailand

Date	Time	Activities
June 27 <sup>th</sup>	-	Arrival Day
	-	Transportation throughout the day from the airport to the hotel (approximately 3.5 hours)
	18:30 - 20:00	Welcome party
June 28 <sup>th</sup>	06:00 - 08:00	Breakfast in the hotel
	09:00 - 12:00	Opening ceremony at SUT hall
	12:00 - 12:30	Juror Meeting at a SUT lecture room
	12:30 - 13:30	Lunch
	14:00 - 17:30	First round of the tournament
	18:00 - 19:30	Dinner
June 29 <sup>th</sup>	06:00 - 08:00	Breakfast in the hotel
	09:00 - 12:30	Second round of the tournament (4-team round start at 8:30)
	12:30 - 13:30	Lunch
	14:00 - 17:30	Third round of the tournament
	18:00 - 19:30	Dinner
June 30 <sup>th</sup>	06:00 - 08:00	Breakfast in the hotel
	09:00 - 12:30	Fourth round of the tournament (4-team round start at 8:30)
	12:30 - 13:30	Lunch
	14:00 - 18:00	Excursion (Ban Rai Temple)
	18:00 - 19:30	Dinner
July 1 <sup>st</sup>	06:00-08:00	Breakfast in the hotel
	09:00-12:30	Fifth round of the tournament (4-team round start at 8:30)
	12:30-13:30	Lunch
	15:00-21:30	Phimai Historical Park tour and Banquette

Date	Time	Activities
July 2 <sup>nd</sup>	06:00-08:00	Breakfast in the hotel
	09:00-18:00	Excursion (KhaoYai National Park)
	18:00-19:30	Dinner
July 3 <sup>rd</sup>	06:00-07:30	Breakfast in the hotel
	08:00-13:00	Final of tournament at SUT hall
	13:00-14:00	Lunch
	14:00-16:00	Awards and Closing ceremony at SUT hall
	17:30-20:30	Dinner and Farewell party
July 4 <sup>th</sup>	06:00-08:00	Breakfast in the hotel Everyone except IOC depart to the airport / BKK (Tourist options at your own expense but we can arrange for those who are interested.)
	09:00-12:00	IOC depart to Ayutthaya (Old capital of Thailand, 200 years ago)
	12:00-13:30	Lunch
	13:30-18:30	IOC Meeting
	18:30-19:30	Dinner
	20:00-22:00	IOC Meeting (optional)
July 5 <sup>th</sup>	06:00-08:00	Breakfast in the hotel
	08:30-12:30	IOC Meeting
	12:30-13:30	Lunch
	13:30-18:00	Sightseeing of the old town
	18:30-20:30	Annual IOC dinner on a big boat
July 6 <sup>th</sup>	06:00-08:00	Breakfast in the hotel
	08:00-10:00	IOC depart to the airport / BKK

# Sponsors and Supporters

## Co-Organizers



## Gold Sponsor



## Silver Sponsor



## Bronze Sponsor



## Sponsor



# IYPT Executive Committee



**Alan Allinson**  
President



**Martin Plesch**  
Secretary General



**Ilya Martchenko**  
Treasurer



**Samuel Byland**  
Elected Member



**Qian Sun**  
Elected Member



**John Balcombe**  
Member  
(Chair, LOC 2014)



**Prapun Manyum**  
Member  
(Chair, LOC 2015)



**Olga Inisheva**  
Member  
(Chair, LOC 2016)

# IYPT International Organising Committee



**Kathryn Zealand**  
Australia



**Ulrike Regner**  
Austria



**Igor Timoshchenko**  
Belarus



**Marcio Martino**  
Brazil



**Assen Kyuldjiev**  
Bulgaria



**Chuanyong Li**  
China



**Stanislav Panos**  
Czech Republic



**George Laskhishvili**  
Georgia



**Rainer Reichle**  
Germany



**Mihály Hömöstrej**  
Hungary



**Dina Izadi**  
Iran



**Myeung Hoi Kwon**  
Korea



**Iat Neng Chan**  
Macao



**Gavin Jennings**  
New Zealand



**Uno Uno**  
Nigeria



# IYPT International Organising Committee



**Leszek Gladczyk**

Poland



**Sandu Mirel Golcea**

Romania



**Valentin Lobyshev**

Russia



**Ye Yeo**

Singapore



**Frantisek Kundracik**

Slovakia



**Kim Freimann**

Sweden



**Samuel Byland**

Switzerland



**Yung-Yuan Hsu**

Taiwan



**Burin Asavapibhop**

Thailand



**John Balcombe**

United Kingdom



**Valerii Koleboshyn**

Ukraine



**Gerard Jennings**

United States Of America

## Nation



Australia



Austria



Belarus



Brazil

## Team Leaders

Gerri Bernard  
Philip O'Neill

Christian Fellingner  
Julian Ronacher

Artsiom Bury  
Igor Timoshchenko

Marcio Martino  
Tatyana Gonçalves Stankevicius

## Team Members

Aditya Sethi  
Elizabeth Cox  
Grace Rehn  
Kevin Zhang  
Isaac Edwards

Rebecca Frank (Captain)  
Markus Niese  
Iris Seitz  
Luisa Schrempf  
Amir Dellali

Dmitriy Baranov (Captain)  
Anton Rusanov  
Anastasiya Podmazko  
Daniil Yarmolkevich  
Veranika Tokarava

Thiago Ross-White Bergamaschi  
Felipe Gomes de Melo D'Elia  
Thiago Ferreira Kalife  
Matheus Henrique de Almeida Camacho  
Diego Pinheiro de Moura

## Visitors

Charling Li

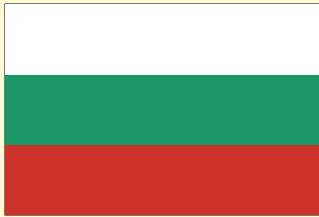
Ibrahim Rebouças  
João Victor de Moraes Morgado  
Elton de Miranda Pita

## Nation

## Team Leaders

## Team Members

## Visitors



Bulgaria

Daniela Ivanova  
Ginka Exner

Nikolay Nikolov (Captain)  
Aleksandar Ivanov  
Simeon Stefanov  
Mitko Benkov  
Dilyan Hristov



China

Jing Chen  
Ming Feng

Kehan Lu (Captain)  
Jingxian Wang  
Jiahong Yi  
Zhenyan Gong  
Guanghe Cong

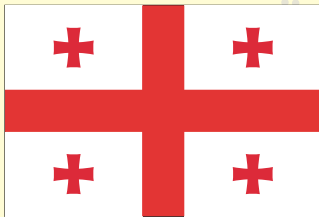
Zhuo Shao  
Ying LI



Czech Republic

Pavel Bakala  
Stanislav Panos

Pavla Beresova (Captain)  
Tomáš Domes  
Pavel Stepanek  
Daniel Rychly  
Petr Sosna



Georgia

Grigol Peradze  
George Laskhishvili

Tsotne Dadiani  
Aleksandre Toidze  
Ekaterine Dadiani  
Giorgi Tsirekidze  
Giorgi Khomeriki

Sophio Japharidze

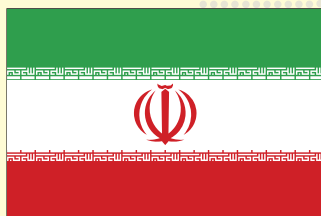
## Nation



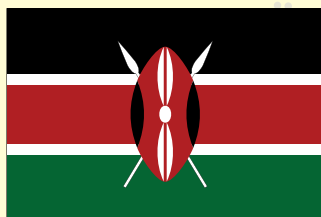
Germany



Hungary



Iran



Kenya

## Team Leaders

Michael Steck  
Rainer Reichle

Peter Ispanovity  
Peter Jenei

Dina Izadi  
Mohammad Qorbani

Devadoss winne Francisco  
Simon Grenwell

## Team Members

Sina Julia Hartung (Captain)  
Jonas Landgraf  
Ann-Kathrin Raab  
Carina Kanitz  
Dominika Stroncsek

Ábel Beregi (Captain)  
András Laukó  
Tina Bánóczki  
Noel László Plaszkó  
Ákos Biró

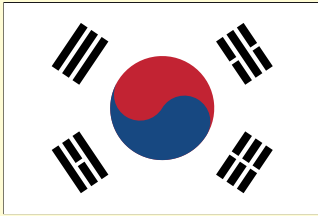
Amirhossein Ebadi (Captain)  
Nazila Sharifi Amina  
Ghazal Naghdibak  
Yasamin Masoumifidkhani  
Anahita Abdollahi

Nathan Spencer Antrobus (Captain)  
Sousuke Narabu  
Xiong Zhuang  
Iruga Wanjau  
Samman Singh Vohra

## Visitors

Jan Oliver Loeffken

## Nation



Korea

## Team Leaders

Kwang Joo Kim  
Byunghoon Chung

## Team Members

Sebeom Lee (Captain)  
Ahn Cheong Eung  
Jiwoo Kim  
Jiwon Han

## Visitors

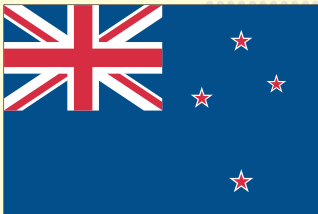
Ho Young Kang  
Jongtak Park



Macao

Wenbiao Xie  
Iat Neng Chan

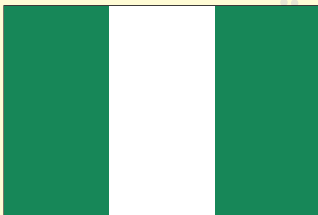
Jingyi Xie (Captain)  
Philip Naderev Lagniton  
Chou Hou In  
Louise ung  
Chin Hok Leong



New Zealand

Michael Pot  
Kent Hogan

Matthew Randle  
Nicholas Lam  
Catherine Pot  
Jack Tregidga  
Tess Breitenmoser



Nigeria

Labake Ajoke Fadipe  
Uno Uno

Oluwatuminiu Elushade (Captain)  
Abdulsamad Abdulsalam  
Simisola Rebecca Banjo  
Ahmad Abdullahi  
Yusuf Shittu

Francis Ejike Ekwenta

Nation	Team Leaders	Team Members	Visitors
 <p>Poland</p>	<p>Lukasz Gładczuk</p>	<p>Radost Waszkiewicz (Captain)                      Anna Wald                      Frederic Grabowski                      Oskar Grudziński                      Bartłomiej Marchliński</p>	<p>Karolina Wróbel</p>
 <p>Romania</p>	<p>Victor Paunescu                      Sandu Mirel Golcea</p>	<p>Horia Magureanu (Captain)                      Alexandra Modrea                      Anca Goldis                      Alexandra Băduț                      Dimitrie Mititelu</p>	
 <p>Russia</p>	<p>Pavel Krovovny                      Andrey Shchetnikov</p>	<p>Vitalii Matiunin (Captain)                      Pavel Ianko                      Stepan Zakharov                      Nikolay Sibiryakov                      Aleksei Budantcev</p>	<p>Allbert Sharafutdinov</p>
 <p>Singapore</p>	<p>Guan Kheng Sze                      Joy Tan</p>	<p>Jin Ming Koh (Captain)                      Yu Jun Shen                      Yu Tse Lee                      Wittmann Goh                      Jun Heng Lim</p>	<p>Yan Qi Huan</p>

## Nation



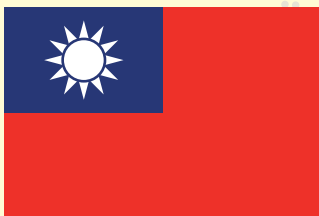
Slovakia



Sweden



Switzerland



Taiwan

## Team Leaders

Michal Hledík  
Zuzana Coculova

Damir Basic Knezevic

Eric Schertenleib  
Daniel Keller

Neng Chun Chiu  
Hung-Chih Kan

## Team Members

Natália Ružičková (Captain)  
Miroslav Gašpárek  
Ádám Urbán  
Martin Murin  
Eduard Oravkin

Alexander Åkesson  
Daniel Jacobsson  
Toomas Liiv  
Fransiska Aspegren  
Ivar Eriksson

Lioba Heimbach (Captain)  
Phyllis Barth  
Michael Rogenmoser  
Kathrin Laxhuber  
Marc Bitterli

Ching Kuo (Captain)  
Yin-Chieh Cheng  
Hao yu Ku  
Samuel Kan  
Neng-Tai Chiu

## Visitors

Maria Anghel

Nation	Team Leaders	Team Members	Visitors
 <p>Thailand</p>	<p>Wiwat Youngdee Burin Asavapibhop</p>	<p>Narawich Wongkhammul (Captain) Pian Pawakapan Chanatip Thanasarnthungcharoen Nontapat Sinsuntithet Panithan Jeerasuwannakul</p>	
 <p>Ukraine</p>	<p>Valerii Koleboshyn Zakhar Maizelis</p>	<p>Olha Zaitseva (Captain) Mykyta Rohovyi Yevhen Melnyk Nazar Pyvovar</p>	
 <p>United Kingdom</p>	<p>Steve Adams John Balcombe</p>	<p>Dominic Dootson (Captain) Tom Dodd Nick Champion Ross Viljoen Yuqing Xu</p>	
 <p>United States of America</p>	<p>Gerard Jennings Andrei Klishin</p>	<p>John Lukowski Andrew Mangabat Brian Tu David Nascari Karl Sewick</p>	<p>Regina Speaker Palubinsky</p>



# Team Leader **Jurors**



**Philip O'Neill**  
Australia



**Julian Ronacher**  
Austria



**Igor Timoshchenko**  
Belarus



**Tatyana Gonçaves  
Stankevicius**  
Brazil



**Ginka Exner**  
Bulgaria



**Ming Feng**  
China



**Stanislav Panos**  
Czech Republic



**George Laskhishvili**  
Georgia



**Rainer Reichle**  
Germany



**Peter Jenei**  
Hungary



**Dina Izadi**  
Iran



**Kwang Joo Kim**  
Korea

# Team Leader **Jurors**



**Iat Neng Chan**

Macao



**Kent Hogan**

New Zealand



**Uno Uno**

Nigeria



**Sandu Mirel Golcea**

Romania



**Andrey Shchetnikov**

Russia



**Joy Tan**

Singapore



**Zuzana Coculova**

Slovakia



**Daniel Keller**

Switzerland



**Hung-Chih Kan**

Taiwan



**Burin Asavapibhop**

Thailand



**Zakhar Maizelis**

Ukraine



**John Balcombe**

United Kingdom



**Andrei Klishin**

United States of America

# Independent Jurors



**Alan Allinson**

Australia



**Ulrike Regner**

Austria



**Valiantsin Astashynski**

Belarus



**Assen Kyuldjiev**

Bulgaria



**Feng Song**

China



**ChuanYong Li**

China



**Dagmar Panosova**

Czech Republic



**Teimuraz Chichua**

Georgia



**Iliia Lomidze**

Georgia



**Florian Ostermaier**

Germany



**Mihály Hömöstreï**

Hungary



**Kerry Parker**

New Zealand

# Independent Jurors



**Susan Napier**

New Zealand



**Leszek Gladczuk**

Poland



**Ilya Martchenko**

Russia



**Olga Inisheva**

Russia



**Valentin Lobyshev**

Russia



**Ye Yeo**

Singapore



**Frantisek Kundracik**

Slovakia



**Lars Gislen**

Sweden



**Mattias Andersson**

Sweden



**Kim Freimann**

Sweden



**Felicia Ullstad**

Sweden



**Yung-Yuan Hsu**

Taiwan



**Volodymyr Kulinskyi**

Ukraine

# Problems for the 28th IYPT 2015

Released by the IOC on July 11<sup>th</sup>, 2014

*“Would you tell me, please, which way I ought to walk from here?”  
“That depends a good deal on where you want to get to,” said the Cat.  
Lewis Carroll*

## 1. Packing

The fraction of space occupied by granular particles depends on their shape. Pour non-spherical particles such as rice, matches, or M&M’s candies into a box. How do characteristics like coordination number, orientational order, or the random close packing fraction depend on the relevant parameters?

## 2. Plume of Smoke

If a burning candle is covered by a transparent glass, the flame extinguishes and a steady upward stream of smoke is produced. Investigate the plume of smoke at various magnifications.

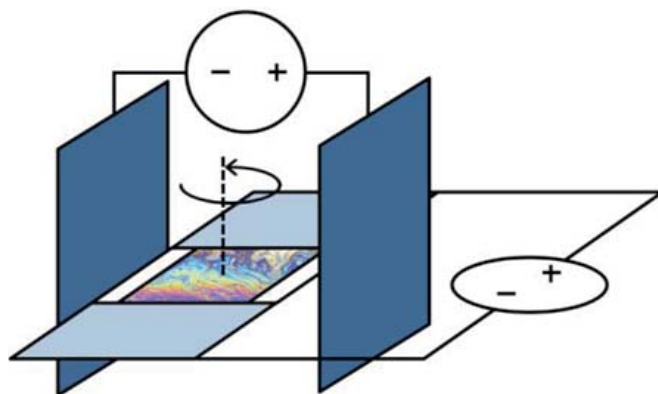
## 3. Artificial Muscle

Attach a polymer fishing line to an electric drill and apply tension to the line. As it twists, the fibre will form tight coils in a spring-like arrangement.

Apply heat to the coils to permanently fix that spring-like shape. When you apply heat again, the coil will contract. Investigate this ‘artificial muscle’.

## 4. Liquid Film Motor

Form a soap film on a flat frame. Put the film in an electric field parallel to the film surface and pass an electric current through the film. The film rotates in its plane. Investigate and explain the phenomenon.



## 5. Two Balloons

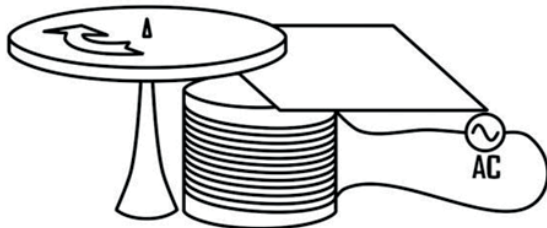
Two rubber balloons are partially inflated with air and connected together by a hose with a valve. It is found that depending on initial balloon volumes, the air can flow in different directions. Investigate this phenomenon.

## 6. Magnus Glider

Glue the bottoms of two light cups together to make a glider. Wind an elastic band around the centre and hold the free end that remains. While holding the glider, stretch the free end of the elastic band and then release the glider. Investigate its motion.

## 7. Shaded Pole

Place a non-ferromagnetic metal disk over an electromagnet powered by an AC supply. The disk will be repelled, but not rotated. However, if a non-ferromagnetic metal sheet is partially inserted between the electromagnet and the disk, the disk will rotate. Investigate the phenomenon.



## 8. Sugar and Salt

When a container with a layer of sugar water placed above a layer of salt water is illuminated, a distinctive fingering pattern may be seen in the projected shadow. Investigate the phenomenon and its dependence on the relevant parameters.

## 9. Hovercraft

A simple model hovercraft can be built using a CD and a balloon filled with air attached via a tube. Exiting air can lift the device making it float over a surface with low friction. Investigate how the relevant parameters influence the time of the 'low-friction' state.

## 10. Singing Blades of Grass

It is possible to produce a sound by blowing across a blade of grass, a paper strip or similar. Investigate this effect.

## 11. Cat's Whisker

The first semiconductor diodes, widely used in crystal radios, consisted of a thin wire that lightly touched a crystal of a semiconducting material (e.g. galena). Build your own 'cat's-whisker' diode and investigate its electrical properties.

## 12. Thick Lens

A bottle filled with a liquid can work as a lens. Arguably, such a bottle is dangerous if left on a table on a sunny day. Can one use such a 'lens' to scorch a surface?

## 13. Magnetic Pendulum

Make a light pendulum with a small magnet at the free end. An adjacent electromagnet connected to an AC power source of a much higher frequency than the natural frequency of the pendulum can lead to undamped oscillations with various amplitudes. Study and explain the phenomenon.

## 14. Circle of Light

When a laser beam is aimed at a wire, a circle of light can be observed on a screen perpendicular to the wire. Explain this phenomenon and investigate how it depends on the relevant parameters.

## 15. Moving Brush

A brush may start moving when placed on a vibrating horizontal surface. Investigate the motion.

## 16. Wet and Dark

Clothes can look darker or change colour when they get wet. Investigate the phenomenon.

## 17. Coffee Cup

Physicists like drinking coffee, however walking between laboratories with a cup of coffee can be problematic. Investigate how the shape of the cup, speed of walking and other parameters affect the likelihood of coffee being spilt while walking.

**Authors :** AlanAllinson, John Balcombe, Roderick Bloem, Artsiom Bury, Samuel Byland, Nikita Chernikov, Lars Gislén, Łukasz Gładczuk, Timotheus Hell, Mihály Hömöstreij, Stanislav Krasulin, Valentin Lobyshev, Ilya Martchenko, Reza Montazeri Namin, Stanisławświdwiński, Boris Vavrik, Evgeny Yunosov.

**Problem selection committee :** JohnBalcombe, Samuel Byland, IlyaMartchenko.

**Epigraph** selected by EvgenyYunosov.

# The Regulations of the **International Young Physicists' Tournament**

## **I. International Young Physicists' Tournament**

The International Young Physicists' Tournament (IYPT) is a competition among teams of secondary school students in their ability to solve complicated scientific problems, to present solutions to these problems in a convincing form and to defend them in scientific discussions, called Physics Fights (PF).

## **II. The problems of the IYPT**

The 17 problems are formulated by the International Organizing Committee (IOC) and sent to the participating countries not later than in October. These problems may be used in any competition that could lead to selection of a national team. They may be used in International tournaments that involve foreign teams not taking part in IYPT.

## **III. The participants of the IYPT**

### *1. The national teams*

Any invited country, as well as the host country, is represented by one team. A country can

only take part in the IYPT if it is nominated and accompanied either by the country's IOC representative or by the representative of a candidate IMO.

### *2. The membership of the teams*

A team is composed of five secondary school students. All members of the team must either be citizens of the country they represent, or be enrolled as students in a school of the country they represent. Secondary school graduates can participate in the IYPT in the year of their graduation. The participation of university students is not allowed. The LOC may allow participation of teams of four or three students. The composition of the team cannot be changed during the Tournament. The team is headed by a Captain who is the official representative of the team during the PFs.

*3. The team is accompanied by one or two team leaders.*



#### IV. The Jury

The Jury is nominated and organized by the LOC in cooperation with EC. The Jury consists of at least five members, if possible from different countries. Team leaders, at least one from each team, are included in the Jury. The team leaders cannot be members of the Jury in the PF where their teams participate and should not, if possible, grade the same team more than twice.

#### V. The agenda of the IYPT

The IYPT is carried out in a period determined by the LOC (from May to July).

All teams participate in five Selective PFs. Selective PFs are carried out according to a fixed schedule as detailed in the attachment to these Regulations. Numbers are ascribed to teams by lot. The best teams participate in the Final PF.

The host country provides a cultural program for the participants.

#### VI. The Physics Fight regulations

Three or four teams participate in a PF, depending on the total number of teams. In the course

of a PF the members of a team communicate only with each other.

Before the beginning of a PF, the Jury and the teams are introduced.

The PF is carried out in three (or four) Stages. In each Stage, a team plays one of the three (four) roles: Reporter, Opponent, Reviewer (Observer). In the subsequent Stages of the PF, the teams change their roles according to the schemes:

##### *Three teams PF*

Stage	1	2	3
Team			
1	Rep	Rev	Opp
2	Opp	Rep	Rev
3	Rev	Opp	Rep

##### *Four teams PF*

Stage	1	2	3	4
Team				
1	Rep	Obs	Rev	Opp
2	Opp	Rep	Obs	Rev
3	Rev	Opp	Rep	Obs
4	Obs	Rev	Opp	Rep

## VII. The Stage regulations

The performance order in the Stage of a PF:	Reserved time in minutes
The Opponent challenges the Reporter for the problem.....	1
The Reporter accepts or rejects the challenge .....	1
Preparation of the Reporter .....	5
Presentation of the report.....	12
Questions of the Opponent to the Reporter and answers of the Reporter.....	2
Preparation of the Opponent .....	3
The Opponent takes the floor, maximum 4 min. and discussion between the Reporter and the Opponent.....	14
The Opponent summarizes the discussion .....	1
Questions of the Reviewer to the Reporter and the Opponent and answers to the questions .....	3
Preparation of the Reviewer.....	2
The Reviewer takes the floor.....	4
Concluding remarks of the Reporter .....	2
Questions of the Jury.....	5

In the Final PF the procedure of challenge is omitted. The official language of the IYPT is English.

## VIII. The team performance in the Stages

**The Reporter** presents the essence of the solution to the problem, attracting the attention of the audience to the main physical ideas and conclusions.

**The Opponent** puts questions to the Reporter and criticizes the report, pointing to possible inaccuracy and errors in the understanding

of the problem and in the solution. The Opponent analyses the advantages and drawbacks of both the solution and the presentation of the Reporter. The discussion of the Opponent should not become a presentation of his/her own solution. In the discussion, the solution presented by the Reporter is discussed.

**The Reviewer** presents a short estimation of the presentations of Reporter and Opponent. **The Observer** does not participate actively in the PF.

During one PF only one member of a team takes the floor as Reporter, Opponent or Reviewer; other members of the team are allowed to make brief remarks or to help with the presentation technically. No member of a team may take the floor more than twice during one Selective PF or, as Reporter, more than three times in total during all Selective PFs. During the Final PF any team member can take the floor only once.

The LOC must inform about the devices available for presentations not later than two months before the IYPT.

## **IX. The rules of problem-challenge and rejection**

1. All problems presented in the same PF must be different.
2. Selective PF

The Opponent may challenge the Reporter on any problem with the exception for a problem that:

- a) was rejected by the Reporter earlier;
- b) was presented by the Reporter earlier;
- c) was opposed by the Opponent earlier;
- d) was presented by the Opponent earlier.

If there are less than five problems left to challenge, the bans d), c), b), a) are successively removed, in that order.

During the Selective PFs the Reporter may reject the challenge of three different problems in total without penalty. For every subsequent rejection the coefficient of the Reporter (see section X) is decreased by 0.2. This reduction continues to apply during the following selective PFs. The maximal number of different problems a team is allowed to reject during the whole competition is 8.

The following special rules apply to the last Selective PF:

- The procedure of challenge is omitted. All teams may choose the problem to present. The only exception is that a team may not present a problem, which they presented earlier in the Selective Fights, and all problems presented in one group must be different. In case teams of one group choose the same problem, priority is given to the team with the

higher TSP (see section XI).

- Teams must choose their problems for the last Selective Fight at the end of the preceding Selective Fight. The choice must be made public immediately.

- The problem which a team presents in this PF may not be presented again in the Final PF by the same team.

### 3. Final PF

Within four hours after the announcement of the results of the Selective PFs the teams participating in the Final choose their problems. In case teams choose the same problem, priority is given according to the order of presentation in the Final (see section XII). The choice should be made public immediately.

## X.The grading

After each stage the Jury grades the teams, taking into account all presentations of the members of the team, questions and answers to the questions, and participation in the discussion. Each Jury member shows integer marks from 1 to 10. The mean of the highest and the lowest marks is counted as one mark

which is then added to the remaining marks. This sum is used to calculate the mean mark for the team. The mean marks are multiplied by various coefficients: 3.0 or less (see section IX) for the Reporter, 2.0 for the Opponent, 1.0 for the Reviewer and then transformed into points.

## XI.The resulting parameters

### 1. For a team in the PF

The sum of points (SP) is the sum of mean marks, multiplied by the corresponding coefficients and rounded to one decimal.

### 2. For a team in the Tournament

The total sum of points (TSP) equals the sum of SP of the team in all Selective PFs. The number of fights won (FW) is the number of Selective PFs, in which a team received the highest SP from all three or four teams participating in the same PFs.

## XII.The Final

The three teams having the highest TSP in the Selective PFs participate in the Final. In case teams have equal TSP, their participation in the Final is decided by FW. If team(s) winning all their Selective PFs (FW=5) did not reach the

Final by TSP, the best of them (determined by TSP) takes part in the final as fourth team.

The order of presentation in the Final is determined by position by entering the final: the higher the position, the higher the number in the scheme of section VI.

### **XIII. The final team ranking of the IYPT**

Students in the top half (rounded up) of participating teams receive medals. The students of the team winning the Final are awarded the winners' cup. If two or three teams have the same SP result in the Final, the winner is nominated according to the highest TSP, in case of equality by FW. All teams participating in the final are awarded 1<sup>st</sup> place certificates and gold medals. The five best teams not participating in the final are awarded 2<sup>nd</sup> place certificates and silver medals. 3<sup>rd</sup> place certificates and bronze medals are awarded to students in all other teams finishing in the top half. All other students receive certificates of participation. Team leaders obtain certificates indicating the ranking of their team.

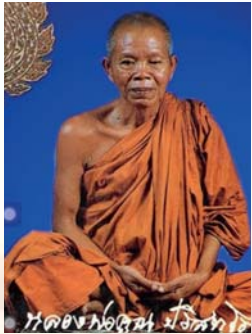


### **XIV. The status of the regulations of the IYPT**

The regulations are established by the IOC and may be changed only by the IOC.

*Accepted in Shrewsbury on 2014-07-11*

# Excursions-Ban Rai Temple



Temple is famous for highly revered buddhist monk “**Loangpor Khoon**”, Who stay at the temple everyday and many people across Thailand and others countries come to visit, pay respect and receive blessing from him. Another most interesting place is his museum , it reflect his life stories and how we was one with high veneration, sacrifices, and dedication in the country. Also there another with high esteem, “**Viharn Dhepwittayakhom**” the Shrine of Pure Wisdom, considered a Dhamma Park wich is located in the middle of a large swamp of Ban Rai Temple. It was intend to house the holy scriptures of Buddhism, Tipitaka, a teaching life of Buddha. Shrine of Pure Wisdom is the first display in Tipitaka for public learning center.

[www.watbaanrai.com](http://www.watbaanrai.com)



# Phimai Historical Park



Phimai Historical Park is in Phimai District. It has one of the grandest and most important Khmer historical sites in Thailand that is the Phimai sanctuary.

The word Phimai appears in an inscription on a stone slab at the front doorway of the building as well as in many other structures. It is believed that the word Phimai meant a religious figure or site.

Phimai sanctuary is in the shape of a rectangle and is 565 metres wide and 1,030 metres long. It consists of structures made of sandstone and laterite, all ornately carved with designs.





The most special characteristic of the sanctuary is that it is the only one that faces south while others usually faces east. This is probably because it was built to face the route that the Khmers made from the capital of the empire, to the south of Phimai.

From stone inscriptions and the style of architecture, Phimai sanctuary was most likely built at the end of the 16th Buddhist century during the reign of King Suriyaworaman I. The architectural style is Baphuon that prospered at the time. Some characteristics are similar to the Angkor Wat style, which became popular at a later period. The site had some additions in the early 18th Buddhist century in the reign of King Chaiworaman VII when Phimai had close relations with the Khmer Empire. The sanctuary was always a religious site of the Mahayana sect of Buddhism because King Suriyaworaman I and King Chaiworaman VII were followers of the sect.



# Khao Yai National Park

Khao Yai National Park has an area of about 2,168 square kilometres in the Phanom Dong Rak mountain range. It covers 4 provinces; Nakhon Ratchasima, Nakhon Nayok, Saraburi, and Prachin Buri. In the past when there were no roads through the area, Khao Yai was regarded among travelers as a wild and dangerous place. The jungle here divides the Central Region and the Northeast. Khao Yai became Thailand's first national park on 18<sup>th</sup> September 1962 and is an ASEAN World Heritage because of its variety of flora and fauna.

The general terrain of Khao Yai National Park consists of mixed forests and rainforests. Some parts have wide plains interspersed with verdant forests. There are many valuable plants, including plants that are traded, scented plants and herbs. There are several mountains, with peaks ranging from 800-3,000 metres above sea level. Due to its altitude and the lush jungles here, Khao Yai has a cool climate even in summer, with an average temperature of 23 degrees Celsius. Khao Yai gets the most visitors in the cool season from October to February. In the rainy season, trekking is not as convenient,



but the area is refreshingly green and all the waterfalls are full of water, sending echoes all around and creating a lively atmosphere for visitors.

Wild animals that can be frequently seen include deer that graze on grass plains and sometimes come to feed around the park office. Other animals are elephants, sun bears, wild boars, monkeys, tigers, gaurs, and mountain goats. The park built 2 wildlife watchtowers at Mo Singto and Nong Phak Chi. Visitors are allowed up there during 8 a.m. - 9 p.m. Those who want to go on a night safari by car can contact the tourist center office before 9 p.m.

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