

## ASTRONOMY OLYMPIADS A CHALLENGE FOR FUTURE SCIENTISTS

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**Abstract.** Contests in astronomy for secondary school pupils, very often called "Astronomy Olympiads", have acquired a general recognition in many countries. They are regarded in various manners: as the best way to attract to science young talented people in general, the possibility to discriminate the most successful participants, who are then in position to be offered to become students of famous universities which is viewed as the beginning of a nice career, the possibility of affirmation of astronomy in secondary schools, the way to put together young amateur astronomers from various parts of the world, etc. On the other hand, there are some organisational problems which follow such events; they concern the relationship with the International Astronomical Union, outreach of the contests in different countries and many others. Serbia has been a member in the Astronomy-Olympiad Movement from 2002.

### 1. INTERNATIONAL CONTESTS IN ASTRONOMY TODAY

At present there exist two international contests in astronomy for teenage pupils. The word "international" should be understood as something covering the whole world (similarly to the case of International Astronomical Union).

The contest known as "International Astronomy Olympiad" (IAO) is older, it took place for the first time in 1996. The other contest, "International Olympiad on Astronomy and Astrophysics" (IOAA) appeared in 2007. Both take place once a year. Due to this in 2012 we had the 17th IAO and VI IOAA.

The two contests have much in common which is not surprising. There are three contest rounds: theoretical, practical (also known as data analysis) and observational. In both cases in the framework of the theoretical round a contestant is required to solve a set of problems. The problems are mostly based on the knowledge of astronomical (physical) background rather than on an advanced mathematics. A special property of IOAA is the existence of two sorts of problems - "short" and "long" ones. The short problems, clearly, can be solved within a shorter time interval, but they are much more numerous than the long ones (usually 15 and 2, respectively), therefore their weight (number of points) is smaller. A special property of IAO is the lower age limit (14) and, consequently, the contestants are divided into two age categories - juniors and seniors; to be a junior contestant one may be also 15, but provided that this is the first participation. These two age groups do not have the same tasks

to solve in the framework of the three rounds. The other two rounds (data analysis and observational) in the two contests are rather similar. Data analysis includes both the treatment of observational data, as well as the data taken from a catalogue. In both cases the use of computers is not foreseen (just as in the case of theory contestants are allowed to use only pocket calculators). The observational round is foreseen to take place, whenever possible, under open sky. For this purpose an additional night is always borne in mind for the case that during the first night the weather conditions are not favourable. If even during the second night the conditions are also unfavourable, then the alternative possibility is realised, the observational round takes place "under a roof" (often in a planetarium). In both cases (IAO and IOAA) the observational tasks have a short duration and a contestant is expected to know the sky (constellations, bright stars, famous objects) very well. In other words the observational round does not resemble too much the practice of astronomical observations, especially not as this is the case nowadays; more precisely almost no measuring and also no error estimation.

It is clear that almost in all of participating countries internal contests take place. They can have several levels (subnational levels and the national one). The evidence shows that in this matter there are great differences from country to country.

Finally, there are also contests in astronomy which cover a sufficiently large group of countries where these countries have something in common; examples are Asian-Pacific Astronomy Olympiad (APAO) and Olimpiada Latinoamericana de Astronomia y Astronautica (OLAA). In the first of these cases the gathering factor has a geographical nature, but in the second one there is also the language factor (Spanish and Portuguese). In general language is an important factor because in the case of a multi-language contest the problems and tasks are originally in the official language (languages) of the contest, to be translated then into national languages by team leaders. Therefore, existence of contests where the official language (languages) is (are) close to all participants, practically with no need for translation, is not surprising. The development of IAO may be a good example, it was preceded by a contest which covered the countries from the Russian speaking area, so today IAO has two official languages: English and Russian. On the other hand, being founded as a purely international contest IOAA has only one official language – English.

## **2. OBJECTIVES OF A CONTEST IN ASTRONOMY**

The objectives of a contest in astronomy for secondary-school pupils may be divers. They certainly depend on particular conditions in a country. First of all there are countries with a rich tradition for contests in astronomy. Examples are the Russian Federation (also all other countries of the former Soviet Union) and Poland. On the other hand, the increasing interest in such contests in recent times in Asian countries is noticeable. However, the experience of both IAO and IOAA indicates the weak interest of countries with highly developed professional astronomy (absence of the USA, the UK, France, Germany, Australia, Spain).

Among the objectives one can meet identification of talented students regarded above all as future university students with astronomy (astrophysics) as the main subject (e. g. Eskin et al. 2012). In general very successful contestants view their success as a way to "pave their roads" towards enrolling prestigious universities. It is well known that some former contestants, who had achieved excellent results at IAO

or IOAA, later became students at universities like Cambridge, Harvard, etc. This is also the case with international contests in mathematics, physics, chemistry and so on. In the case of astronomy contests, for reasons already stated above, one can find out that these contestants were from countries situated in middle/eastern Europe or Asia, as a rule, not too rich countries and almost without famous universities. Therefore, an entrance ticket to a prestigious university, including a scholarship, is, of course, something very valuable.

When objectives are the topic, one should not, certainly, forget the promotion and dissemination of astronomy. According to the existing evidence, astronomy is hardly present as a special subject in the under-university level of education. Also ordinary people are often ignorant as to understanding of celestial phenomena. Therefore, it is very important to involve as many pupils as possible in a kind of astronomy teaching. The participation in a national (international) contest may serve as an additional stimulus for attending such kind of astronomy teaching. In particular, one bears in mind the so-called extra-teaching, i.e., to meet the necessities of more interested pupils who would get an opportunity to learn more than what is foreseen in the school syllabus.

Another objective of contests in astronomy may concern the situation with developing countries. Universities and colleges are indispensable as sources and places where sophisticated knowledge is acquired. They are in some way connected to the teaching process on lower education levels. However, the distribution of prestigious universities (world map) is far from uniform. Countries, usually referred to as developing, have in general problems with high-quality education. Therefore, the case of an international contest putting together pupils from all over the world can be very useful. In this way educators from developing countries will be able to gather a large amount of valuable information, which can have a positive impact on the improvement of the teaching process in general and, especially in the case of such an extraordinary science as astronomy is. It should be said that the International Astronomical Union has recognised this objective as very important.

Whenever astronomy is the topic, one should not forget amateur astronomers. Usually they are organised within proper societies. With regard to the well-known fact that the enthusiasm decreases with age most of the members of such societies are rather young persons, secondary-school pupils. Many of them try their chance within a contest. In this way an international contest in astronomy offers the possibility of putting together young amateur astronomers from many mutually distant countries at one place, which helps them exchange the experience.

### **3. CONTESTS IN ASTRONOMY VERSUS ORGANISATIONAL PROBLEMS**

As said above, there exist two international (tending to cover the whole planet) contests in astronomy. At first glance this circumstance may seem favourable because of a "sound" competition. However, in a science like astronomy this may have not good consequences. The attending countries differ in their approaches. In some of them the general policy seems to be like "the more contests, the better", so they send regularly their teams (mostly not the same pupils) to both international contests. On the other hand, there are countries which, though very interested in astronomy contests in general, cannot, for various reasons, send teams regularly to both contests.

Finally, the attitude of some countries can be described as reluctant because, though known to have contests in astronomy inside themselves, they still have not sent a team to either of the two contests. The reason of this reluctance may be just that they have not been able to choose between the two options, leaving to the future to identify the decisive advantage of one of the two contests present now. The attitude of the International Astronomical Union (Commission 46) is also interesting; though through a letter IOAA was recognised, no official of Commission 46 has ever come to greet personally an IOAA contest. On the other hand, some IOAA officials find such an attitude favourable because of the worry that a closer relationship with IAU could result in a limitation of IOAA independence. Certainly, all of this is followed by financial problems. Perhaps, among them one should look for the reason why some countries attend regularly contests covering parts of the world (already mentioned Latin America, Asia and Pacific), but have never sent a team to either of the two international contests. If a brief statistics including countries which have attended contests in astronomy sufficiently regularly (say more than once, any of the four mentioned above) were made, a set of 38 countries could be formed with the following geographic distribution: Latin America 8, Europe 18, Asia 12. A number approaching 40 is obtained, it is curious to note that the host country of the next IOAA in 2013, Greece, has made its plan, just based on the contingency of 40 participating countries!

#### **4. THE ROLE OF CONTESTS IN ASTRONOMY IN SERBIA**

For the first time Serbia attended an international contest in astronomy in 2002. It was the seventh IAO. This required the foundation of a national contest in astronomy (National Astronomy Olympiad) in Serbia. The Serbian National Contest serves as a selection of contestants for international contests. From 2007 the National Contest has been regularly preceded by a regional contest (contests). It also has a selective role since contestants having too bad results are not allowed to take part in the National Contest. All these contests have been characterised by a strong domination of pupils from the Mathematical High School in Belgrade. Pupils from other schools both from Belgrade and from other parts of Serbia have rarely been among the participants. Therefore, it is clear why regional contests for regions beyond Belgrade have not been regular. A good illustration is the fact that among the pupils who have taken part in international contests, there has been no single one from any other school different from the Mathematical High School in Belgrade! Due to this circumstance the number of contestants on the first (regional) level has rarely exceeded 20, which is very small when compared to the analogous data for other countries, but, nevertheless, contestants from Serbia have been very successful at the international contests; by the way they have participated in IAO nine times and four times in IOAA and have brought home more than thirty prizes!

#### **5. INSTEAD OF A CONCLUSION**

What can the near future bring? The present author hopes that the situation with the two international contests will become clearer. Also contests covering parts of the world (continents, subcontinents) and groups of countries with similarities in culture and language, in principle, should not appear as competitive, or excluding, to a purely

international contest, but the money problem can be a severe hindrance, compelling some countries to choose between the two kinds of contest.

As for Serbia, it remains to hope that in the future secondary-school pupils in general will have better opportunities to learn more about astronomy and celestial phenomena making it possible in this way that astronomical contests in Serbia are no longer the privilege of the Mathematical High School in Belgrade. Of course, the rich tradition of successful participation in international contests is expected to be continued also in the future.

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### **References**

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