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Keywords: model crystalline state, factors of phase space, students' comprehension

GI-MS48-P05

The crystallization competition in the school: an innovative teaching/outreach tool for secondary schools

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The 'Crystallization Competition in the School' is a teaching/outreach activity aimed at students aged 12-17, whose main goals are to disseminate the importance of crystallography and crystallization and inspire scientific vocations. Since it was first organised in 2009/2010 (Andalucía/Puerto Rico), the popularity of the Competition has quickly spread across Spain. In this school year (2017/2018), eight editions have been organised in different regions of Spain, counting with the direct participation of 282 schools, 495 teachers and 7,768 pupils.

The format of the Competition is intended to provide school students the experience of being a 'real' scientist: from designing a scientific project, through working in practical crystallization experiments and keeping a laboratory notebook, putting into practise their presentation skills and sharing outcomes with scientists and fellows from other schools. This innovative approach is implemented in three successive stages that place teachers at its heart in order to engage with the entire educational community. At the first stage, teachers are trained in fundamental crystallography and crystallization concepts through the organisation of a practical workshop that provides them with teaching tools and resources that can be turned into enjoyable activities for the classroom. In the second stage, students develop a laboratory project under the supervision of their teachers making use of a motivating crystallization kit of ammonium dihydrogen phosphate (ADP) that enables them to stir their scientific imagination and bring out their scientific spirit. Students can also develop other types of projects such as crystallization of salts by cooling, formation of geodes and crystallization in gels. The final phase of the Competition is organised similarly to a scientific conference, where students make the presentation of a poster, their grown crystals and a lab notebook that is evaluated by a panel of scientists. By the end of the Competition, students will have learnt to behave as 'scientists' and developed work-related scientific values such as observation, systematic study, rational thinking, teamwork and communication skills.

References:

http://www.lec.csic.es/concurso/

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GI-MS48-P06

Symmetry groups in the islamic geometric art: ornamental patterns of Konya (Turkey) and Marrakech (Morocco)

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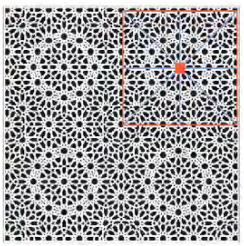
Since the Middle Age, Muslim world has a great artistic and decorative tradition. In this vast space which were spread from Africa to Asia through Andalusia, there are treasures of unmatched beauty in the Islamic geometric art.

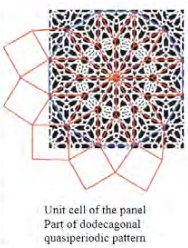
The skill of the master craftsmen, their knowledge of the concept of symmetry have allowed the development of this art over the centuries [1]. Indeed, symmetry is an essential tool in conceiving the ornamental patterns, regardless of their degree of complexity.

Since the end of the 19th century, many authors have been interested in Islamic ornamental motifs. In 1879, Bourgoin compiled nearly 200 geometric patterns. The development of group theory in the 20th allowed the analysis and classification of these motifs from the point of view of symmetry. Some authors [2] have attempted to find the 17 crystallographic groups of the plane established by Fedorov. Other authors have used computer to generate ornamental patterns. Finally, the advent of quasicrystals has led scientists to study some Islamic ornamental patterns as a quasiperiodic tiling [3].

Our purpose, in this presentation, is to study the symmetry in the ornamental art of the Eastern and Western Muslim world. We consider the geometric ornamental patterns found in two millennia cities, Marrakech and Konya, founded respectively by the Almoravid in Maghreb, and the Seljuk in Asia. The richness of the ornamental patterns achieved on several supports (stone, ceramic, wood, plaster, ...) allows an easy approach of the plane crystallographic groups, perfectly suitable for the introduction of group theory in crystallography.


Wall panel- Saadian Tombs
16th Century – Marrakech


Reproduction of the panel by the authors
Symmetry group: p4mm


Unit cell of the panel
Part of dodecagonal
quasiperiodic pattern