

Aspen Institute Italia Award 2018
Crystal from space looks set to benefit research and industry

*The quest for forbidden crystals*¹. This is the title of the project that has been declared winner of the third edition of the [Aspen Institute Italia Award](#) for scientific research and collaboration between Italy and the United States. The study was undertaken by the following two scientists:

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Crystals follow laws of symmetry dictated by mathematics that have been known for some time. Around thirty years ago, however, the existence of another "class" of materials was hypothesized, midway between the crystalline and vitreous states. These materials, called forbidden crystals or quasicrystals, are now commonly produced in the laboratory.

Yet although quasicrystals are now an accepted phenomenon, there is still no general consensus regarding their long-term stability. The question was whether nature could help resolve the matter. Indeed, if such structures were truly stable, they should also be found in nature. The study describes the search for a natural quasicrystal, begun in the mineralogical collection of the Museum of Natural History at the University of Florence, where a find was reported in 2009. Doubts over the authenticity of this specimen provided the impetus for a field expedition undertaken by a team of Italian, Russian, and American scientists in easternmost Siberia, from where the mineral in Florence had been collected.

The expedition collected other specimens of the mineral, with a surprise twist: testing showed that they originated from outer space. The minerals are fragments of a meteorite and point to the quasicrystals having been formed in space, not on Earth. Future studies into how these quasicrystals were formed could therefore yield new information on the conditions in the primordial solar system and the formation of the planets.

Being relatively poor conductors of heat and electricity, quasicrystals have interesting properties that open up significant prospects for their industrial use. These properties are already currently finding application in the field of coatings, such as for non-stick film for saucepans or for razor blades, and in the military field (in the form of composite paints) to reduce radar detectability.

The winning study, *The quest for forbidden crystals*, demonstrates the ample scope for discovering new quasicrystals in nature (with chemical compositions as-yet unexplored by man in the laboratory) and for extending the results of this new field of research to other scientific spheres and to groundbreaking industrial applications.

¹ The study has been published in several scientific journals, including *Mineralogical Magazine*, 2014, Vol. 78, pp. 467; *Nature Communications*, 2014, Vol.5, pp.4040; *Nature Scientific Reports*, 2014, Vol. 4, pp. 5869; *Nature Scientific Reports*, 2015, Vol. 5, pp. 9111; *Nature Scientific Reports*, 2016, Vol. 6, pp. 38117; *Nature Scientific Reports*, 2016, Vol. 7, pp. 1637; *PNAS*, 2016, Vol. 113, pp.7077.

THE AWARD

The *Aspen Institute Italia Award* for scientific research and collaboration between Italy and the United States was launched in December 2015 in keeping with the Institute's commitment to encouraging and developing international leadership and transatlantic relations. Every year, the prize will be awarded to a research project studying applied or theoretical natural sciences, in which scientists and/or organizations from Italy and the US collaborate.

The Prize consolidates the Institute's commitment towards initiatives and meetings on important topics in the fields of science and technological innovation, with particular reference to their relevance to Italy. The Jury comprises Aspen Italia Chairman Giulio Tremonti (chair), Luciano Maiani, Professor Emeritus of Theoretical Physics at Rome's La Sapienza University, and Lucio Stanca, Vice Chairman of Aspen Institute Italia and former Minister for Innovation and Technology.

In 2016, the Award was given to *Spatiotemporal spread of the 2014 outbreak of Ebola virus disease in Liberia* which created a mathematical model to interpret the spread of Ebola.

In 2017, the Award was given to *Wind from the black hole accretion disk driving a molecular outflow in an active galaxy that demonstrates that wind coming from black holes contributes to the formation of new stars inside different galaxies.*