# Polyhedron, Nobel Prize and Mathematics

Noriaki Suzuki

Department of Mathematics, Meijo University

Nagoya, Japan,

suzukin@meijo-u.ac.jp

[**0**] Three topics

(1) Find a beautiful polyhedron with 60 vertexes.

(2) $C_{60}$, LED and Nobel Prize.

(3) Mathematics helps Physics and vice versa.

[**1**] Polyhedron

(1) Regular polyhedron : Most simple and beautiful polyhedron (one kind regular face)

(2) Quasi-regular polyhedron : Next simple and beautiful polyhedron (two kinds regular faces)

(3) V: vertexes,  E: edges,  F: faces

(4) V + F = E + 2 (Descartes-Euler formula)

(5) Problem: Let $m, n$ be natural numbers which satisfy $m > 2$, $n > 2$. Then find all couples $(m, n)$ which satisfies the following inequality

$$\frac{1}{m} + \frac{1}{n} > \frac{1}{2}$$

(6) Solution: $(m, n) = (3, 3), (3, 4), (3, 5), (4, 3), (5, 3)$ These correspond to 5 regular polyhedrons.

(7) In 1985, R. Smalley, R. Curl and H. Kroto discovered a new carbon molecule, which is formed 60 carbon atoms. (They were awarded the 1996 Nobel Prize)

(8) The universe is well-ordered. All natural objects are simple and beautiful. What is a simple and beautiful polyhedron with 60 vertexes?

(9) Soccer ball helps Buckyball $C_{60}$ (Mathematics helps Physics).

[**2**] Blue LED and Carbon nanotube

(1) Two famous professors in our university, Isamu Akasaki and Sumio Iijima.

(2) In 1989, Akasaki succeeded to make Blue LED (Akasaki got Nobel Prize in 2014. Incandescent light bulbs lit the 20th century; the 21st century will be lit by LED lamps)

(3) The three primaries of the light (red, green and blue make all colors)

(4) In 1991, Iijima discovered Carbon nanotubes (a family of fullerenes).

(5) Serendipity = Ability to get good luck. (In the fields of discovery chance favors only the prepared minds. Only a suitable person encounters a great discover)

[**3**] Mathematics

(1) Mathematics is thinking.

(2) Learn (= absorb knowledge) and research (= create knowledge)

(3) Problem: Classify all hexahedrons (polyhedron with six polygonal faces).

(4) Relation between Mathematics and Physics (or other sciences)

(5) Problem: Construct the shortest roads which connects $n$ towns (Fermat-Steiner problem).

(6) Soap film gives us a quick answer (surface tension), Physics helps Mathematics.