Albert Einstein medals

and the 100th anniversary of General Relativity

Bend Coin Club of Central Oregon
November 17, 2015

Presentation and photos by Eric Holcomb

Introduction

- This presentation shows a group of medals (and one coin) honoring the life and scientific discoveries of Albert Einstein, named “Person of the Century” (for the 20th Century) by *Time* magazine. When *Time* made its selection in December 1999, their editors explained as follows:
  - “In a century that will be remembered foremost for its science and technology — in particular for our ability to understand and then harness the forces of the atom and the universe — one person stands out as both the greatest mind and paramount icon of our age: the kindly, absentminded professor whose wild halo of hair, piercing eyes, engaging humanity and extraordinary brilliance made his face a symbol and his name a synonym for genius: Albert Einstein.”
- This presentation also commemorates the centennial of Einstein’s theory of General Relativity, which was presented in its final form on November 25, 1915, in a lecture given by Einstein at the Prussian Academy in Berlin, entitled “The Field Equations of Gravitation.”

Introduction (cont.)

- Einstein was born in March 1879 in Germany, later studied at the Polytechnic in Zurich, Switzerland, and became a Swiss patent examiner.
- He first rose to prominence within the physics community in 1905 (his "miracle year") when he published four groundbreaking papers:
  - On the photoelectric effect.
  - On Brownian motion (helping to establish the atomic and molecular basis of matter).
  - On special relativity (best known for predicting "time dilation" near the speed of light).
  - On the equivalence of matter and energy (the famous $E = mc^2$).
- In 1915 he followed up with his theory of general relativity (replacing Newton's theory of gravity), which remains to this day as one of the two pillars of modern physics (along with quantum mechanics).
- When his prediction of the bending of starlight by the sun was confirmed during a total solar eclipse in May 1919, he became world famous, and was awarded the Nobel Prize in Physics for 1921, although the Nobel committee cited his "services to the theory of physics" and his "law of the photoelectric effect" because relativity was still considered controversial.

The Times of London headline

November 7, 1919 (after eclipse data published):

REVOLUTION IN SCIENCE

New Theory of the Universe

NEWTONIAN IDEAS OVERTHROWN

"Einstein's newly confirmed theory will require a new philosophy of the universe, a philosophy that will sweep away nearly all that has hitherto been accepted."

Introduction (cont.)

- In 1933, Einstein decided to emigrate to the United States to escape Nazi Germany and the persecution of the Jews. He eventually took up a position at the Institute for Advanced Study at Princeton, New Jersey, an affiliation that lasted until his death in April 1955.
- He is well-known for his letter to President Roosevelt about the possibility of an atomic bomb, leading to the U.S. Manhattan Project. Although he later regretted that letter, he said there was some justification — the danger that the Germans would make them.
- He regarded his relationship with the Jewish people as his "strongest human tie," supporting Zionism and the State of Israel, although declining an offer to serve as the mostly ceremonial President of Israel in 1952.

Understanding Relativity (sort of) Part 1 – Special Relativity (1905)

- Speed of light is the same for all observers, and no object or signal can move through space faster than this speed.
- What does “relativity” mean?
  - Movement is perceivable only as relative movement (no absolute space or time).
  - Measurements of time, distance, etc., can be relative, depending on the motion of the observer. Relativistic “time dilation” is the best known example.
  - Events that appear simultaneous to one observer may not appear that way to another observer. (The “relativity of simultaneity.”)
- These effects are real, and quite dramatic for particles moving close to the speed of light in “atom smashers.” Atomic clocks, including those on GPS satellites, routinely detect and measure time dilation.
- Special relativity does not, however, deal with the effects of gravity or acceleration. Nor does it mean that “everything is relative.”

Understanding Relativity (sort of) Part 2 – General Relativity (1915)

- Newton's theory of gravity deals with forces of attraction between two or more masses. Defying intuition, the gravitational forces are instantaneous even at great distances, however the math is comparatively simple and easily programmed on a computer. (I've done it myself.)
- Einstein's theory is much more complicated mathematically – mass and energy tell four-dimensional spacetime "how to curve," and curved space in turn tells matter "how to move." This is more like the equations describing the motion of a fluid.
- Equivalence principle – Locally (as inside the elevator in Einstein's famous thought experiment), gravity is the same as acceleration in empty space.
- The effect of gravity propagates like a wave at the speed of light, and is therefore not instantaneous. Gravity wave searches are underway.
- Once again, the effects of general relativity are real, and quite dramatic for astronomical objects such as neutron stars and black holes.
- Gravity bends light, and gravitational lensing of distant galaxies by closer galaxies is routinely observed. Gravity also slows the passage of time.

Relativity and Quantum Physics

- Quantum mechanics, also developed in the 20th Century, is the other great theory of modern physics. It mostly describes the atomic world, including especially the quantization of energy levels, and the “uncertainty principle.”
- Einstein was also one of the pioneers of quantum mechanics, with his explanation of light quanta and the photoelectric effect.
- However, Einstein was uncomfortable with the concept of uncertainty in physics, and famously said that “God does not play dice with the universe.” This is often misunderstood. Einstein was well aware of the *apparent* randomness of the atomic world, but thought there were “hidden variables” that if understood would remove the randomness.
- Einstein also sought (unsuccessfully) a unified theory of all the forces of nature. This became more complicated with the discovery of nuclear forces, in addition to the previously known forces of gravity and electromagnetism. Modern physics now includes nuclear forces within the quantum framework, but a quantum theory of gravity remains elusive to this day.

Enough Physics …

Now we'll show a sampling of the many numismatic items commemorating Einstein.

Israel Coins & Medals Corp.

- Issued by: Israel Government Coins & Medals Corp., Ltd. Part of a series of six medals honoring “Jewish Contributors to World Culture.”
- Obverse: portrait of Albert Einstein.
- Reverse: Wise Observatory, Tel-Aviv University.
- Diameter: 50 mm; Edge: plain, "STATE OF ISRAEL / 999 / 0019 (serial number)."
- Finish: antique; Composition: .999 silver; Weight: 60 g.
- Mintage: 1,500.

Israel Coins & Medals Corp.

- Issued by: Israel Government Coins & Medals Corp., Ltd. Part of a series of six medals honoring “Jewish Contributors to World Culture.” Same design as the smaller silver medal.
- Diameter: 59 mm; Edge: plain, "STATE OF ISRAEL / BRONZE / 0464 (serial number)."
- Finish: antique; Composition: bronze; Weight: 98 g.
- Mintage: unknown.

China Commemorative Coin

- Issued by: People's Republic of China. Part of a series that also includes coins commemorating Mozart and Columbus, this is an indication of the international respect for Einstein.
- Denomination/Catalog: 10 Yuan, KM# 375.
- Obverse (officially the reverse): portrait of Einstein at the blackboard with some equations including $E = mc^2$.
- Reverse: symbols/emblem of the PROC, date 1991.
- Diameter: 38 mm; Edge: reeded; Finish: bright cameo proof.
- Composition: .925 silver; Weight: 27.1 g.

Franklin Mint medal (1)

- Issued by: Franklin Mint (presumably for sale in Germany).
- Obverse: portrait of Einstein with dates born/died.
- Reverse: various symbols/equations, including sun, spacetime diagram, atom and $E = mc^2$. German legend *Der schopferische genius des Deutschen geistes. (The … genius of the German spirit.)* Since the end of World War II, Germany has renounced its Nazi past and embraced Einstein and other Jews.
- Diameter: 39 mm; Edge: plain, ERSTAUSGABE NR 0768 (serial number), Franklin Mint symbols, year 1977; Finish: bright cameo proof; Composition: .925 silver; Weight: 24 g.

Franklin Mint medal (2)

- Issued by: The Franklin Mint (designer Joseph Boulton) for the National Commemorative Society.
- Obverse: portrait of Einstein, PHILOSOPHER · SCIENTIST. There was an embarrassing error in that some of these medals have 1875 (instead of 1879) as Einstein's birth year, which was corrected.
- Reverse: tree of knowledge, globe, quotation about world as a "Great Eternal Riddle."
- Diameter: 38.1 mm (1.5 inches); Edge: reeded except for FM markings and serial numbers, year 1968; Finish: bright cameo proof; Composition: .925 silver; Weight: 26 g.

Franklin Mint medal (3)

- Issued by: The Franklin Mint.
- Obverse: portrait of Einstein (with that famous "wild halo of hair") smoking a pipe, $E = mc^2$.
- Reverse: "Einstein, Great Scientist and Humanitarian, etc.," dates born/died. (This time they got it right on the first try!)
- Diameter: 38.1 mm (1.5 inches); Edge: plain except for FM markings and serial number, date 1973; Finish: bright cameo proof; Composition: bronze; Weight: 24 g.

Longines medal

- Issued by: Longines Symphonette (part of a series).
- Obverse: portrait of Einstein, boy (Einstein himself?), sun deflecting starlight, $E = mc^2$, dates born/died.
- Reverse: "Albert Einstein, one of history's greatest physicists, laid the foundation for the atomic age, etc."
- Diameter: 40 mm; Edge: plain except for Longines markings, 342 (serial number); Finish: antique; Composition: .925 silver; Weight: 34 g (net silver weight 1 Troy ounce).

Shell Oil Company medal

- Issued by: The Franklin Mint for Shell Oil Company. (Thus demonstrating the continuing tendency to use Einstein in advertising campaigns, although at least in this case he was part of a series of famous persons rather than a symbol for genius.)
- Obverse: portrait of Einstein, date 1968.
- Reverse: “Shell’s Famous Facts & Faces Game.”
- Diameter: 26 mm; Edge: plain; Finish: semi-bright luster.
- Composition: aluminum; Weight: 2 g.

Russian medal

- Issued by: believed to have been made in Russia.
- Obverse: portrait of Einstein.
- Reverse: cross-like shape, dates born/died, ЭИНШТЕИН (EINSTEIN in Cyrillic).
- Diameter: 60 mm; Edge: plain; Finish: antique.
- Composition: bronze; Weight: 127 g. (The heaviest medal in this group.)

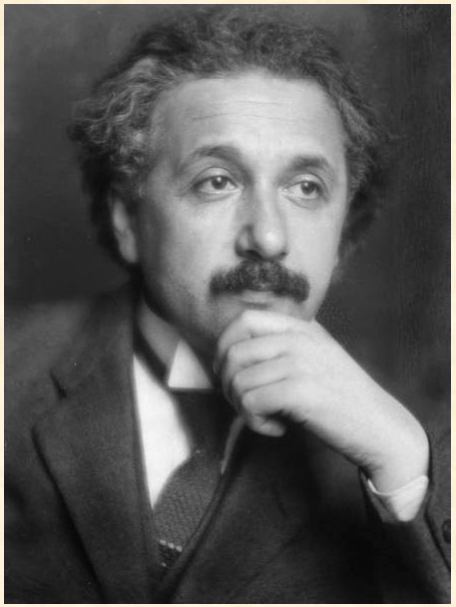
Hamilton Mint bar

- Issued by: The Hamilton Mint.
- Obverse: portrait of Einstein, equations leading up to $E = mc^2$.
- Reverse: “Our Greatest Americans, etc.”
- Size: 25.4 x 50.8 mm (1 x 2 inches); Edge: plain; Finish: bright cameo proof (with partially textured reverse).
- Composition: .999 silver; Weight: 32 g (1+ Troy ounce).

References

- *Time* magazine, December 31, 1999.
- Wikipedia.org (http://en.wikipedia.org/wiki/Albert_Einstein).
- Isaacson, Walter, *Einstein—His Life and Universe*, Simon & Schuster, New York, 2007.
- William M. Rosenblum, LLC, website http://www.rosenblumcoins.com/. A numismatic dealer in Israel, Palestine and Jewish numismatic material (ancient to modern).
- *Standard Catalog of World Coins*, 1901-2000, 37th Official Edition (2010), Krause Publications, Inc.
- Note: Einstein coins and medals are usually assigned numbers according to Harry Flower's catalog. (His collection was the most complete and comprehensive collection of Einstein medals.)

Imagination



1921 photo of Einstein by E. O. Hoppe (1878-1972), published in *LIFE.*

"Imagination is more important than knowledge.

For knowledge is limited, whereas imagination embraces the entire world."

— *Albert Einstein*