Harvard University
Gazette

November 30, 1979 V

Professor Jaffe Shares Heineman Award in Physics

Professor **Arthur Jaffe** (Mathematical Physics) and **James Glimm**, a mathematician at Rockefeller University, will share the Heineman Award for solving part of a fundamental problem in physics.

The professors, who have worked together for years, will receive the joint $5,000 award at the annual meeting of the American Physical Society in January. The Heineman Prize for Mathematical Physics, which went in 1977 to Nobel Laureate **Steven Weinberg**, Higgins Professor of Physics, is considered one of the country's highest awards for research in physics. Mr. Jaffe will also receive the New York Academy of Science Award for Mathematical and Physical Sciences at a ceremony December 6.

"The work Jaffe and Glimm have done is a mathematical *tour de force*," says **George Mackey**, Landon T. Clay Professor of Mathematics and Theoretical Science. "They tackled an important unsolved question in physics and have come a long way toward solving some aspects of it."

The problem involves the apparent "incompatibility" between special relativity, a key law that defines time and space in nature, and quantum mechanics, a set of laws which governs how elementary *particles interact*.

Some physicists believe that the two principles have already been reconciled according to general laws of physics. Others like Mr. Jaffe believe there is still no coherent mathematical theory that reconciles special relativity with the larger framework of quantum mechanics.

Special relativity works for the macrocosm which describes any configuration of matter larger than an atom or molecule, according to Mr. Mackey. But it doesn't by itself work for the microcosm—the world of subatomic particles. Both special relativity and quantum mechanics are needed to describe this world of elementary

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Mathematical Tour de Force Wins Heineman

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particles.

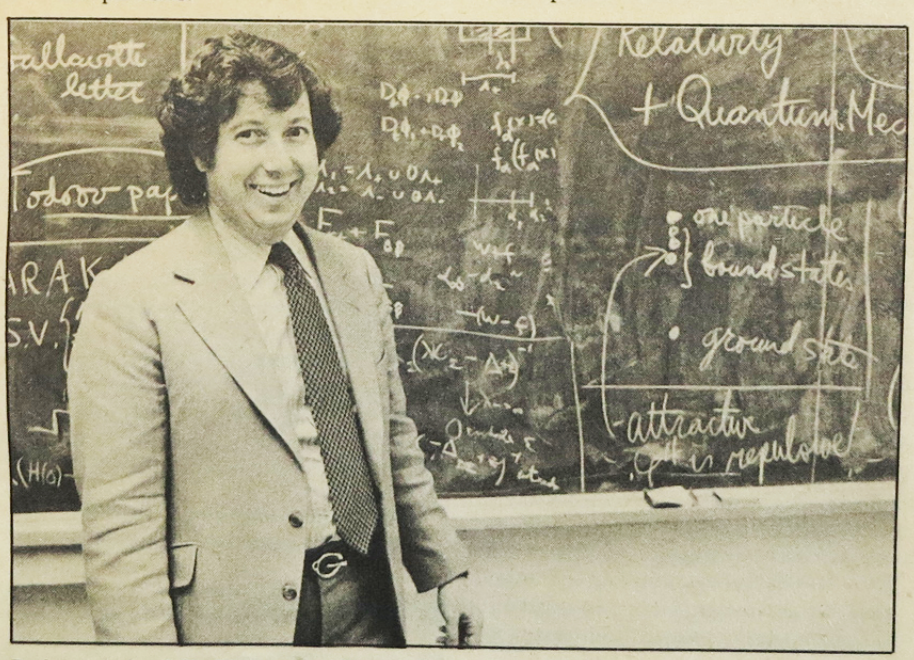
According to scientists, quantum mechanics describes the interaction of elementary particles such as protons, neutrons, and electrons. To explain how electrons and atomic nuclei interact, a physicist can use the "language" of quantum mechanics without special relativity. But if he wants to explain how protons and neutrons collide at extremely high nuclear energies, special relativity becomes important.

"At high energies, these particles come very close to each other and move through each other, converting energy into new matter," explains Mr. Jaffe. "Einstein's theory of special relativity must be used to understand this conversion of energy into new particles."

For the past decade, Professors Jaffe and Glimm have attempted to develop mathematical theory that would reconcile quantum mechanics and special relativity. Recently, the two theoretists developed a mathematical theory showing a compatibility between special relativity and quantum mechanics in a wide variety of simplified models of elementary particle interactions.

What remains unsolved is the construction of a similar theory for the complex equations now being used by particle physicists to describe actual elementary particle interactions.

Mr. Jaffe has trained a large number of the younger mathematical physicists now working at universities in this country and in Europe.



Professor Arthur Jaffe (Mathematical Physics) shows how he and his colleague, James Glimm, resolved mathematically an apparent "incompatibility" between special relativity and quantum mechanics. Professors Jaffe and Glimm will share this year's Heineman Award in Physics. (Photo: Michael Nagy)