Tracing the Rich History of Physics Research at NBS/NIST Through the Pages of the Journal of Research of the National Institute of Standards and Technology (NIST)

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Introduction

The *Journal of Research of NIST* is the flagship publication of the National Institute of Standards and Technology. It has been published under various titles and forms since 1904, with its roots as *Scientific Papers* issued as the *Bulletin of the Bureau of Standards*.

In announcing the first volume, S.W. Stratton (first Director of the Bureau) wrote, "the *Bulletin* … will embody the results of its investigations, research, and other work which may be of importance to the scientific, technical, and manufacturing interests of the country."

Today, the *Journal* continues to serve as a major mechanism for NBS/NIST scientists to report on their research in metrology and related fields of physical science, and has been the venue for papers of some of the most influential American physicists of the twentieth century.

The papers highlighted here represent some of the significant accomplishments of NBS/NIST physicists. Some were selected because they are considered classic publications; others were selected because they were authored by notable NBS/NIST physicists.[1] Citation counts are based on searches performed in Thomson Scientific's *Web of Science,* February 2008. Of the 38 million source papers indexed in *Web of Science*, about half are never cited.[2]

[1] NIST Special Publication 958, *A Century of Excellence in Measurements, Standards, and Technology: A Chronicle of Selected NBS/NIST Publications, 1901-2000.*

[2] Garfield, E. (2005). "The Agony and the Ecstasy: The History and Meaning of the Journal Impact Factor."

Electrical Metrology

Edward B. Rosa (1861-1921), Chief Physicist and first Division Chief of the Electricity Division of the National Bureau of Standards (NBS), authored over 30 scientific papers published in the *Bulletin*. His work provided the basis for the international pre-eminence of NBS/NIST in electrical metrology.

Rosa contributed two papers to the first volume of the *Bulletin* – "The Absolute Measurement of Inductance" and "The Absolute Measurement of Capacity." The former was presented at the International Electrical Congress in 1904 and was written, "in response to overwhelming needs in U.S. industry for a single, consistent basis for measurements of power, current, impedance, and voltage to support the electrical power industry." [1]

Radiometry

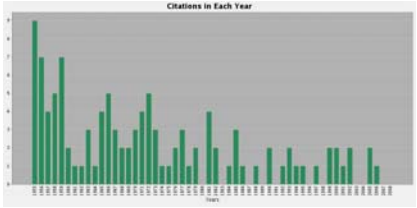
William W. Coblentz's (1873-1962) work at NBS resulted in several hundred papers in optical research; almost 90 of these were published in the precursors to the *Journal of Research*. His 1916 review paper, "Present Status of the Determination of the Constant of Total Radiation from a Black Body," led to the establishment of the science of radiometry at the Bureau. This paper appeared in volume 12 of the *Bulletin* along with his paper, "Studies of Instruments for Measuring Radiant Energy in Absolute Value: An Absolute Thermopile."

Coblentz's cumulative body of work published in the *Bulletin* and its successors, spanning over 30 years, has been cited over 700 times.

Atomic Physics

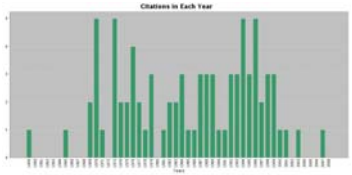
Ugo Fano (1912-2001) is believed to be the first theoretical physicist hired by NBS. In his twenty year tenure at NBS, he published four papers in the *Journal of Research*.

His paper, "Penetration and Diffusion of X-Rays - Calculation of Spatial Distributions by Polynomial Expansion," published in the *Journal of Research* in 1951, cited over 130 times, is among his most highly cited journal articles. His other highly cited *Journal* papers are "Electric Quadrupole Coupling of the Nuclear Spin with the Rotation of a Polar Diatomic Molecule in an External Electric Field," published in 1948, and "Penetration of X- and Gamma-Rays to Extremely Great Depths," published in 1953. The graph below shows the citation pattern for Fano's 1951 paper.



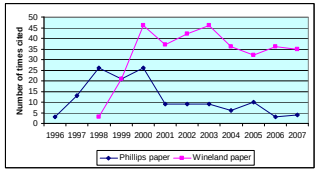
Atomic Spectra

While best known for her work in compiling the three volumes of tables in the *Atomic Energy Levels* series (Circular of the National Bureau of Standards 467), Charlotte E. Moore (1898-1990) published several papers in the *Journal of Research* between 1950 and 1970. The 1959 *Journal* paper she co-authored with Herbert P. Broida, "CH in the Solar Spectrum," has been cited over 80 times. The graph below shows the citation pattern for this paper.



Laser-Cooling of Atoms

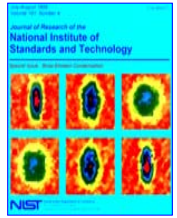
In the 1990s, two significant papers on the laser-cooling of atoms appeared in the *Journal of Research*. William D. Phillips, co-winner of the 1997 Nobel Prize in Physics, co-authored a 1996 paper titled, "A Spectroscopic Determination of Scattering Lengths for Sodium Atom Collisions." This paper has been cited 139 times. A 1998 paper written by David J. Wineland and colleagues, "Experimental Issues in Coherent Quantum-State Manipulation of Trapped Atomic Ions," has been cited 340 times. The graph below shows the citation patterns for these two important papers.



Bose-Einstein Condensation

In its most highly cited special issue (July-August 1996), the *Journal of Research* celebrated the work of NIST physicist Eric A. Cornell and his colleagues with a special issue devoted to Bose-Einstein condensation. Cornell was a co-recipient of the 2001 Nobel Prize in Physics for research leading to the landmark 1995 creation of the Bose-Einstein condensate and early studies of its properties.

The Bose-Einstein Condensation Special Issue (vol. 101, no. 4) contains 15 articles authored or co-authored by important NIST physicists including Eric A. Cornell, William D. Phillips, and Paul S. Julienne. In total, the issue's 15 articles have been cited 499 times.



Conclusion

The papers highlighted here demonstrate the technical excellence of NBS/NIST research and the value of the *Journal of Research* as a source of information on physics research at NIST. Some of the best work performed in the laboratories of NBS/NIST was first announced in the *Journal*. While the papers here represent a few selected topics, other important areas of physics research documented in the pages of the *Journal* include:

- Acoustics
- Cryogenics
- Photometry
- Time and Frequency

The current and archival issues of the *Journal* are available at http://www.nist.gov/jres.

The authors are librarians in the Electronic Information and Publications Group of the Information Services Division of Technology Services at the National Institute of Standards and Technology. They have performed extensive analyses on the Journal of Research and other NBS/NIST publications.