

The Wardenclyffe Story

A recent film on Tesla, with a brief Introduction
Sebastian White, CERN/Princeton
Split, September 22, 2016

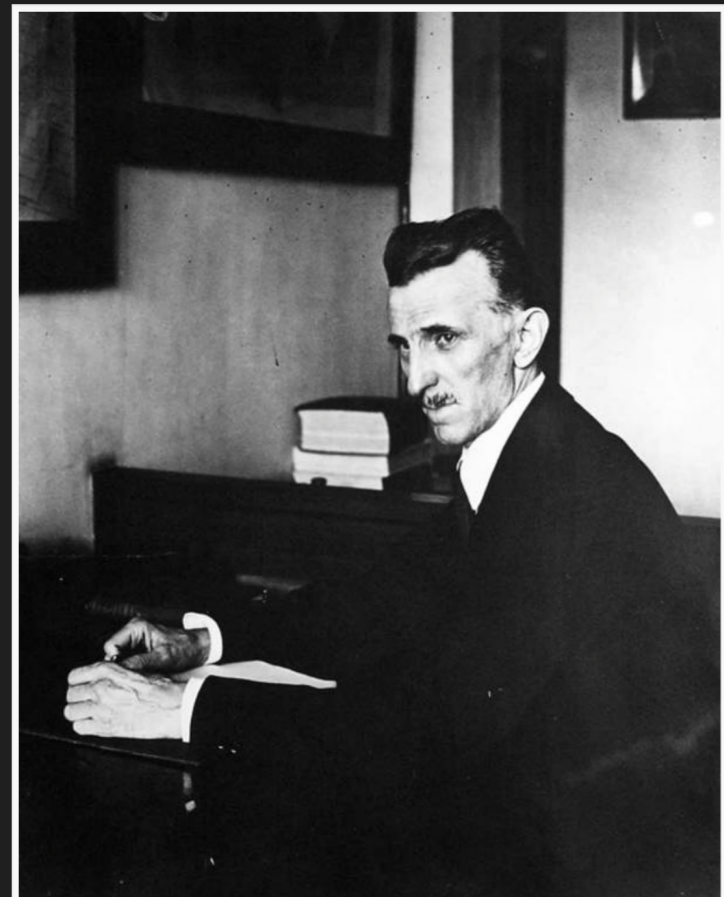


Tesla, Rutherford and the Birth of the age of Accelerators



2015-“The Year of Light”
also marked the 150th anniversary
of Maxwell’s significant paper:

J.C. Maxwell, “A Dynamical Theory of the
Electromagnetic Field”,
Phil. Trans. Roy. Soc. London 155, 459 (1865)



Nikola Tesla(1856-1943)

- perhaps more than anyone, brought the theory to practice
- translated it into a spirit of scientific and industrial optimism in the US (and Europe).

years 1892-1893 were important for:

- Columbia World Exposition (below)
- Tesla’s European tour- where he met JJ Thompson, Kelvin, von Helmholtz, Hertz and others.
- Thompson’s student, Rutherford, arrived at Cambridge in 1895 and briefly held a record in radio transmission.

what was Tesla's influence on Rutherford?

my thanks to Marc Seifer for finding this letter.

Rutherford certainly read the

TC Martin Tesla compendium:

"The Researches, Writings and Inventions of Nikola Tesla"
, when it came out in 1895.

This book includes Tesla's lecture on the wave/particle nature
of light and a solar model of atoms.

LS-64

CAVENDISH LABORATORY, CAMBRIDGE

March 19th, 1936

*The Chairman
The Society for Founding Nikola Tesla's Institute,
Institut Nicole Tesle,
Beograd, Miročka 4
Yugoslavia,*

Dear Sir,

The Vice-Chancellor of the University of Cambridge has handed to me your letter dealing with the Celebration in Belgrade of the Eightieth Anniversary of Nikola Tesla on May 28th, 1936. The University will not be able to send a representative to be present on that interesting occasion, but I have been asked, as Director of the Cavendish Laboratory, to offer our congratulations and good wishes.

I, of course, am well aware of the great contributions Nikola Tesla has made to Electrical Engineering in many directions, and in particular I was greatly impressed in my younger days by his experiments on high frequency currents. I have often made use of the Tesla transformer as a method of producing high voltages in my researches. I am very interested to know that an Institute has been founded in Belgrade in his honour by his countrymen.

I am sure that all scientific men will be delighted to extend their warmest congratulations to Nikola Tesla on his eightieth birthday, and to express their appreciation of his great contributions to Science.

Yours sincerely
RUTHERFORD

Rutherford's Lecture:

*Address of the President, Sir Ernest Rutherford, O.M., at the
Anniversary Meeting, November 30, 1927.*

At this Anniversary Meeting we are naturally conscious of the losses suffered by our Society during the year. These include thirteen of our Fellows and three Foreign Members. We have also to record the loss of one of our Fellows under Statute 12, EDWARD CECIL GUINNESS, EARL OF IVEAGH, elected 1906.

In the short time at my disposal, I would like to make a few remarks on the results of investigations carried out in recent years to produce intense magnetic fields and high voltages for general scientific purposes. In the past our

voltages are required in the laboratory. Scientific men thus naturally follow with great interest advances in these directions, whether undertaken for purely scientific or for technical uses.

It has long been my ambition to have available for study a copious supply of atoms and electrons which have an individual energy far transcending that of the α and β -particles from radioactive bodies. I am hopeful that I may yet have my wish fulfilled, but it is obvious that many experimental difficulties

“the fly in the cathedral”

E. Rutherford, *The scattering of alpha and beta particles by matter and the structure of the atom*, *Philosophical Magazine*, volume 21 (1911),

[669]

LXXIX. *The Scattering of α and β Particles by Matter and the Structure of the Atom.* By Professor E. RUTHERFORD, F.R.S., University of Manchester*.

§ 1. **I**T is well known that the α and β particles suffer deflexions from their rectilinear paths by encounters with atoms of matter. This scattering is far more marked for the β than for the α particle on account of the much smaller momentum and energy of the former particle. There seems to be no doubt that such swiftly moving particles pass through the atoms in their path, and that the deflexions observed are due to the strong electric field traversed within the atomic system. It has generally been supposed that the scattering of a pencil of α or β rays in passing through a thin plate of matter is the result of a multitude of small scatterings by the atoms of matter traversed. The observations, however, of Geiger and Marsden † on the scattering of α rays indicate that some of the α particles must suffer a deflexion of more than a right angle at a single encounter. They found, for example, that a small fraction of the incident α particles, about 1 in 20,000, were turned through an average angle of 90° in passing through a layer of gold-foil about $\cdot 00004$ cm. thick, which

- Moseley, R & Chadwick, Oppenheimer
- “region of anomalous interaction” -> Hostadter
- R to Royal Society, Nov. 1927 -> *time to go industrial*
- 10^{-8} --> $< 10^{-16}$ cm

Electrostatic Accelerators

- Cockroft-Walton
(~1 Megavolt)
 - Rutherford α 's
(~5 Megavolt)
 - Van der Graaf
(10 Megavolt)
-
- Above 10 MeV use high field RF (0.1-1 GHz) up to 10's MeV/meter



Some references for this talk:

- M. Krause film: **Filmarchiv I** Nikola Tesla – Visionär der Moderne (2012)
<https://absolutmedien.de/film/4001/>
- Sikorski Film(released this year on Amazon..) <http://www.amazon.com/TOWER-PEOPLE-Teslas-Wardenclyffe-Continues/>
- Marc Seiffer's book: "Wizard: The Life and Times of Nikola Tesla : Biography of a Genius" (Citadel Press Book) 2001
- my 2011 talk on the CERN website: "Tesla Sparked the Era of Particle Accelerators"
<https://cds.cern.ch/record/1399654>
- an article I wrote on Tesla and Wardencliffe: <http://www.foxnews.com/opinion/2012/11/07/honoring-legacy-american-physicist-and-engineer-nikola-tesla.html>
- "The Fly in The Cathedral", B. Cathcart

Chronology: Years ~1892

European Tour -1892

- Jan. 1892: to London, guest of Preece lecture to Institution of Electrical Engineers
- Lord Kelvin convinced Tesla to repeat lecture next day at Royal Society, Lord Rayleigh chair
(Kelvin, Thompson, Rayleigh, Crookes, Flemming, Lodge....)

“Up to that time I never realized that I possessed any particular gift of discovery, but Lord Rayleigh, whom I always considered as an ideal man of science, had said so and if that was the case, I felt that I should concentrate on some big idea.”-Tesla

- Feb. delivers similar lectures in Paris
- news that T's mother is dying. returns to Gospic and Zagreb for 6 weeks
- brother of Kaiser delivers his Berlin talk in his stead
- On return trip T. visits von Helmholtz in Berlin, Hertz in Bonn

In the US

- 1891: Tesla US citizenship
- 1892: Launches several patents including on electrical transmission
- w. Westinghouse wins contract for lighting Columbia World Exposition
- subsequent contract for Niagra Falls Project (visits 1896)
- von Helmholtz and Lord Kelvin visit his demonstrations at CWE
- 1895: TC Martin publishes Tesla compendium

Tesla's World in NYC: *friends and "frenemies" in high places*

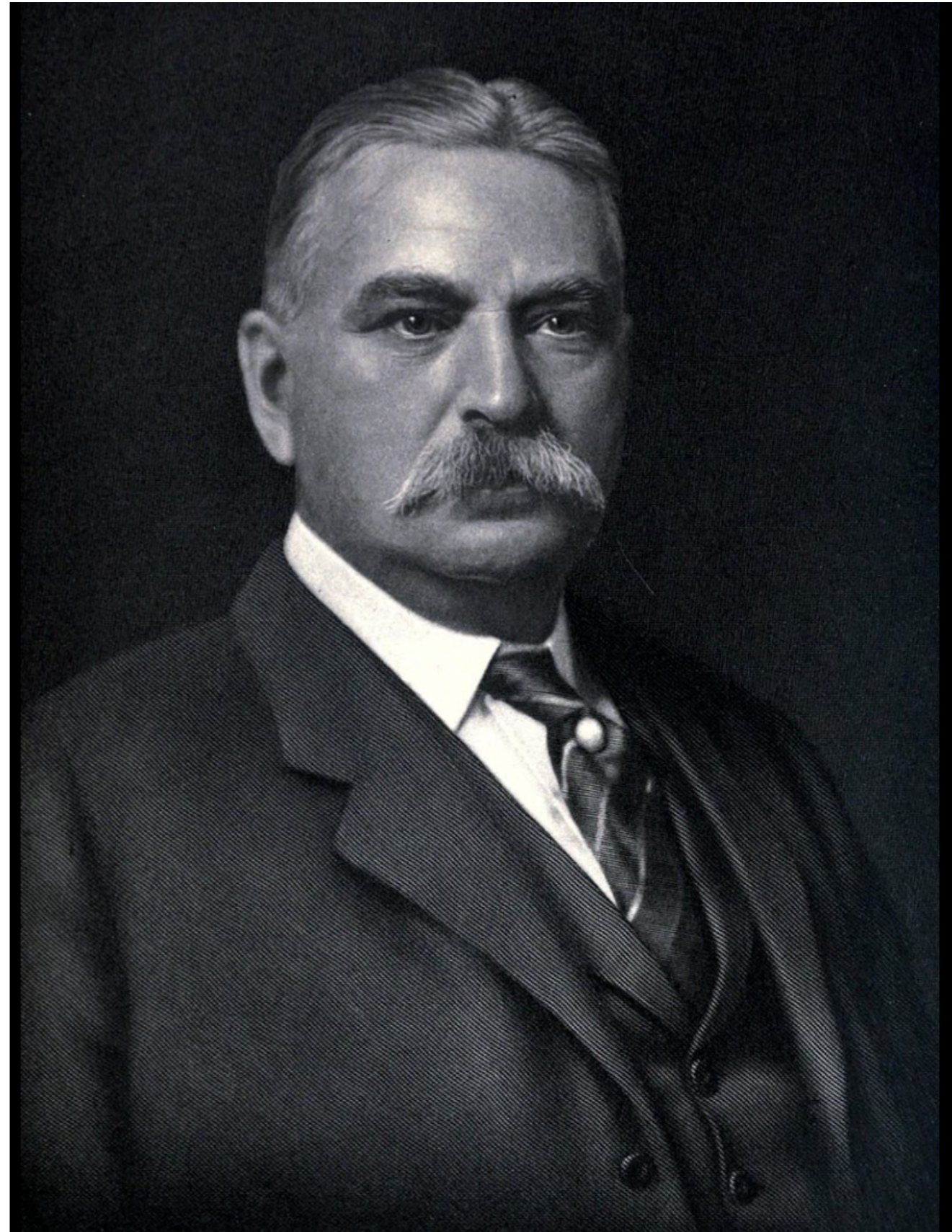
World's Columbian Exposition, Chicago 1893: Beaux Art Architecture+ Tesla AC wiring



Neighbors in the Waldorf-Astoria Hotel:

Henry Clay Frick (& daughter)

John "bet a million" Gates



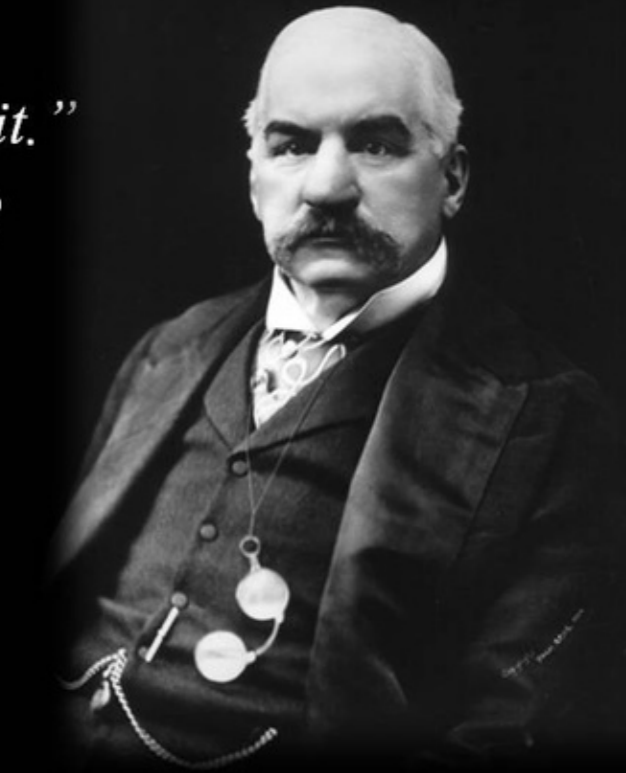
Friend and “frenemy”

JJ Astor IV (and young wife)



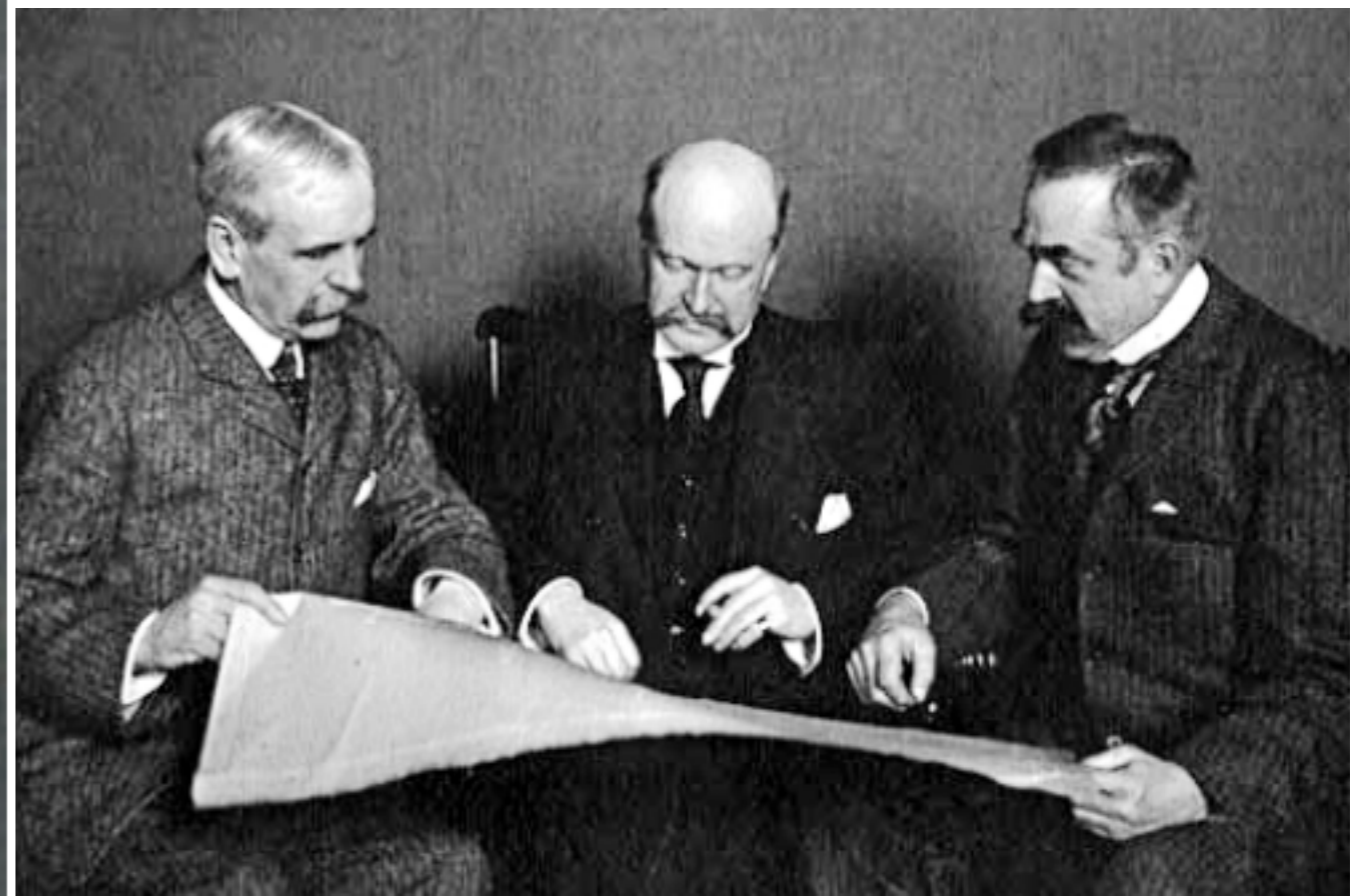
JP Morgan

*“Gold is money.
Everything else is credit.”
- J.P. Morgan, 1912*



- Astor was an early investor in Tesla’s projects and often a good friend
- Morgan was something else

Tesla was a friend of Stanford White and his Family
from left: Stanford, his son Larry (behind W. Wilson), the firm



The American Renaissance(1876-1917)

by Stanford White (age 27), Louis Comfort Tiffany, Herter Bros
restauration under Herzog and deMeuron





WIZARD

THE LIFE AND TIMES OF NIKOLA TESLA
BIOGRAPHY OF A GENIUS

Marc J. Seifer

HIGH SOCIETY (1894-97)

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White for sailing jaunts out at Southampton with a dozen members of the clique.

On one occasion, White asked Tesla to join him for an outing with Mr. William Astor Chamber, an African explorer. As usual, Tesla was busy at work, but after some tactful prodding, he relented. "I am so delighted that you have decided to tear yourself away from your laboratory," White said. "I would sooner have you on board than the Emperor of Germany or the Queen of England.""

The year 1895 was a peculiar one. The U.S. government was nearing bankruptcy. In the Panic of 1893 bondholders had wished to secure gold

LAWRENCE GRANT WHITE
101 PARK AVENUE
NEW YORK

December 21, 1955

Mr. Kenneth M. Swezey
163 Milton Street
Brooklyn 22, N.Y.

Dear Mr. Swezey:

My delay in answering your letter of October 6, in regard to the late Nikola Tesla, is due to the fact that I wanted to rummage through old files of my father's correspondence which are in storage in the country, in the hope that I might find some letters from him. I enclose three letters herewith, hoping that you will return them to me when they have served your purpose.

I remember Tesla well, as he often came down to stay with us on Long Island. He used to wander around at night in the garden in the moonlight; and when my mother asked him why he wasn't asleep, he replied: "I never sleep." I also remember going to his laboratory as a boy, and watching him put several million volts through his body lighting up two Crookes tubes which he held in his hand.

Sincerely yours,

Lawrence Grant White

LGW:MR

Marc Seifer sent above extract from his book and also Stanford White's signature (below right) (top right) a letter from Larry about Tesla's visits to the family

*call for you 1-15
here for Niece
~~at 1000 blocks~~
Sunday night
Very truly yours
Stanford White*

Nikola Tesla



Tesla c. 1890

Tesla and Pupin came from similar backgrounds but not close in NYC
White & St. Gaudens different backgrounds but very close in NYC
both close w. Tesla

Mihajlo Idvorski Pupin



Mihajlo Idvorski Pupin



Architect Stanford White (1853-1906)
in a photograph ca. 1873



Sculptor Augustus Saint-Gaudens (1848-1907)
in a photograph ca. 1884

Augustus Saint-Gaudens



Tesla is trending

- 70 years after his death Tesla's name is showing up everywhere.
- we should remember not only Tesla's accomplishments but also the incredibly fruitful environment he entered in his adopted country
- the story of Tesla enriches our perception of physics and engineering today
- accounts of today's physics (eg at CERN) would also be enriched by knowing the characters of the previous generation
- I have been filming interview material that could add balance to the popular accounts of today's physics