CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Coordinator: Nadia Robotti, Professore ordinario di Storia della Fisica, Dipartimento di Fisica, Università di Genova, Italia.

Participants:

N. Robotti, Dipartimento di Fisica, Università di Genova

F. Guerra, Dipartimento di Fisica, Università di Roma La Sapienza

M. Leone, Dipartimento di Filosofia e Scienze dell'Educazione, Università di Torino

E. Colombi, Liceo Sanvitale (Parma); Deputazione di Storia Patria per le Province Parmensi

Place of Work & Collaborations:

Università di Genova; Università di Torino; Università di Roma La Sapienza; Università di Parma

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

The project aims to analyze the **scientific and civil commitment of Italian physicists over a vast period of time**, including much of the 1800s and the first half of the 1900s.

The researches carried out so far within this project focused on some of these periods.

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

- **Main goals of the project are the studies of**:
  - the contributions of the **physicists in the Senate of the Kingdom** between the Albertine Statute (1848) and the fall of the fascist regime (1943)
  - the **contribution of Italian physicists to the Great War** (1915-1918) in conjunction with the anniversary of the end of the war
  - some aspects of the birth and development of **nuclear physics in Italy**
  - the main scientific, academic and social aspects that preceded and followed the **forced emigration to the United States, at the end of the 1930s, of many Italian physicists**

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

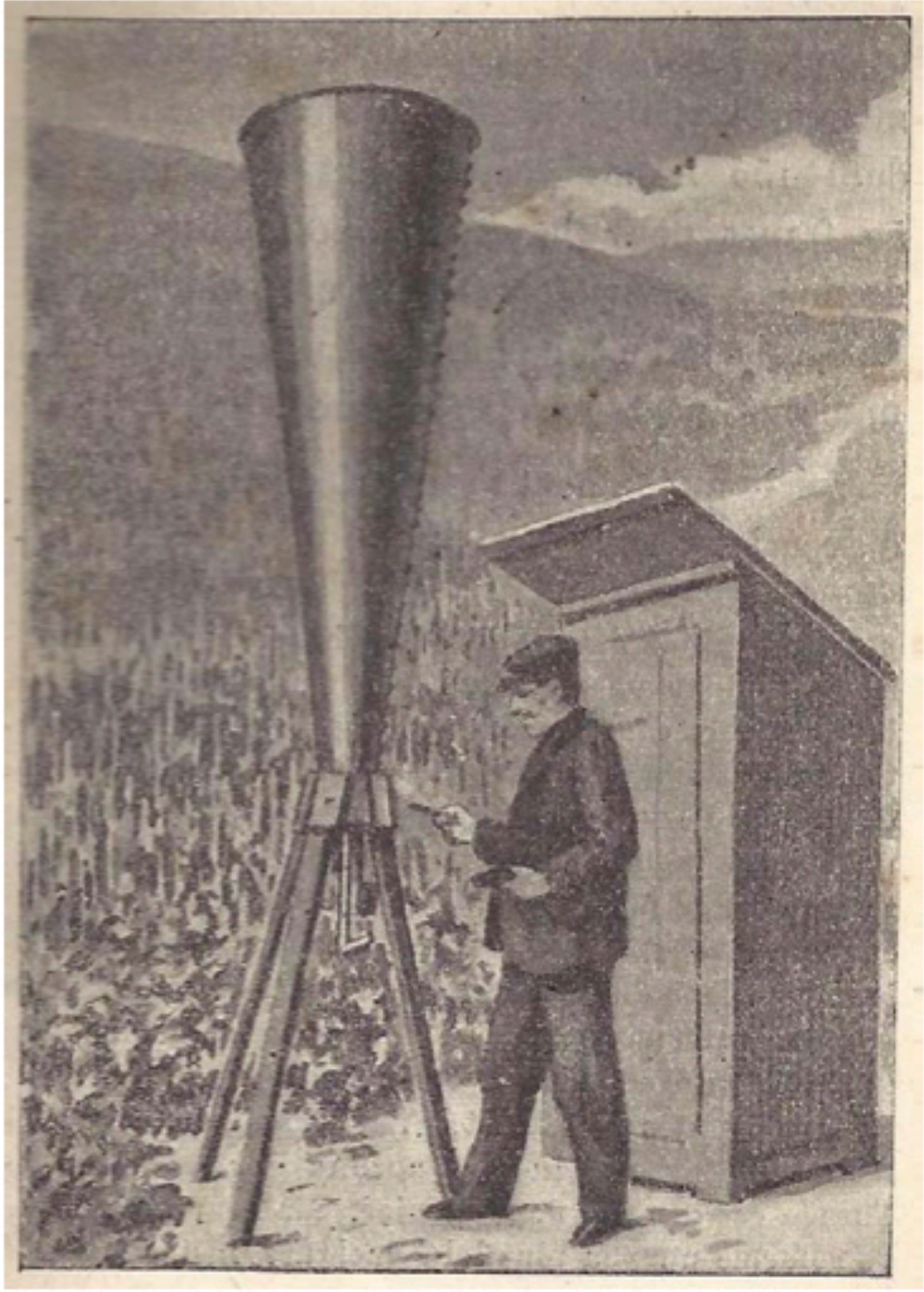
Project main goals and results achieved in 2019

- **Results achieved in 2019**:
  - As regards the activities of the physicists in the Senate of the Kingdom: publication of the book "***I Fisici Senatori: 1848-1943***", edited by SIF in collaboration with Centro Fermi and the Senate of the Republic
  - The volume was **officially presented on 13 September 2019 at the Library of the Senate of the Republic**

Front and back cover of the book **I Fisici Senatori: 1848-1943**

The official presentation of the book at the Library of the Senate (from left to right: G. Trincheri, R. Simili, G. Quagliariello, L. Cifarelli, U. Bottazzini)

- With regard the activities of the physicists in the Senate of the Kingdom, we have analysed a case-study of **collaboration between physicists-deputies and physicists-senators** (in particular, the contributions of the senator **Pietro Blaserna** and the deputy **Angelo Battelli** to the discussion in 1901 on the **anti-hail guns bill**).



ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

- **Results achieved in 2019**:
  - **Italian physicists and the Great War**: The analysis of the collected documentation highlighted how they contributed to a wide spectrum of technologies, **sometimes with desk research but very often with studies "in the field"**

CENTRO FERMI
Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Antonio Garbasso at the war front working on the development of a **sound-ranging technique for the location of the enemy artillery positions**

(see: E. Colombi, F. Guerra, M. Leone, N. Robotti, "The sounds of war: phonotelemetry at the Italian front", **Physics Education**, 54, (2019) 035017)

(see also: E. Colombi, F. Guerra, M. Leone, N. Robotti, "I Fisici Italiani in Guerra: 1915-1918", **Quaderni di Storia della Fisica**, 21:1, (2019), 29-60. ISSN 1594-9974)

Rome, December 2019

Vito Volterra on an airship, while he was engaged on **artillery researches**

Guglielmo Marconi on the Isonzo front, where he was sent to **inspect Italian army's radiotelegraph systems**

Augusto Occhialini (father of "Beppo") **in Washington, D.C.,** as a representative of **Volterra's "Ufficio Invenzioni e Ricerche"** (Ministry of War)

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

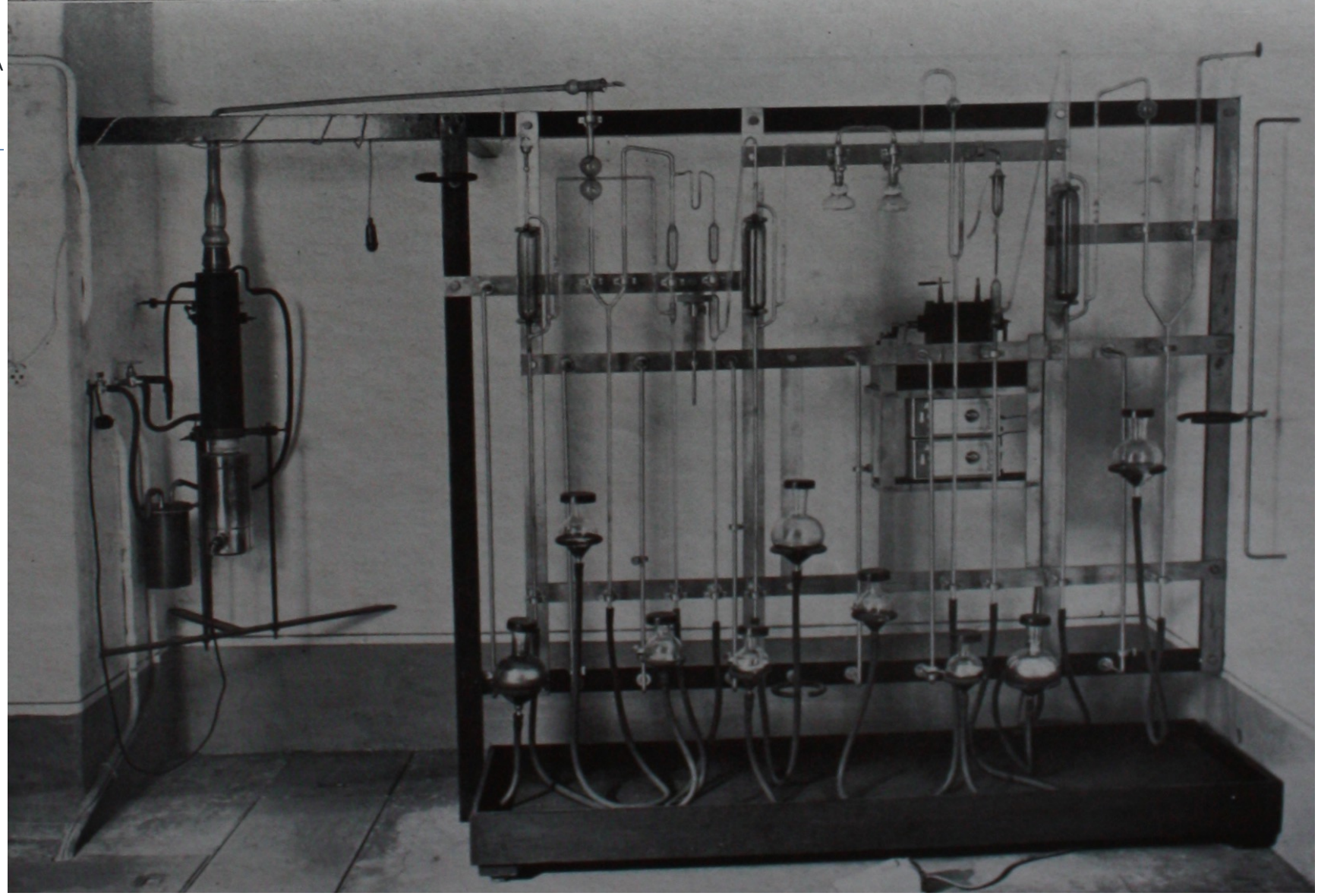
- **Results achieved in 2019**:
  - As regards **birth and development of nuclear physics in Italy**, we have studied the role played by **Aldo Pontremoli**, **Giulio Cesare Trabacchi** and **Ettore Majorana**

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

- We reconstructed **Pontremoli's early interests** concerning the **collision of alpha particles on light atoms**: after a Laurea thesis on this topic, he collaborated with the **Rutherford group in Cambridge** thanks to a **scholarship** from the **Opera Nazionale Combattenti** (1920). This was a sign of **Corbino's great foresight**. He sent Pontremoli to the research center where **just one year before the discovery of proton had occured.**

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

- In reference to **Trabacchi**, we reconstructed his scientific biography and collected archival documents on his activity within the **"Ufficio del Radio"** of the General Directorate of Public Health



Trabacchi's radon extraction plant at the "Ufficio del Radio" (Direzione Generale della Sanità Pubblica)

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

- As regards **birth and development of nuclear physics in Italy**, we have reconstructed the activity in nuclear physics in Rome after Fermi's departure, with reference to the research carried out with the 1.1 MeV **Cockroft-Walton built at the Istituto Superiore di Sanità** by E. Amaldi, D. Bocciarelli, G.C. Trabacchi

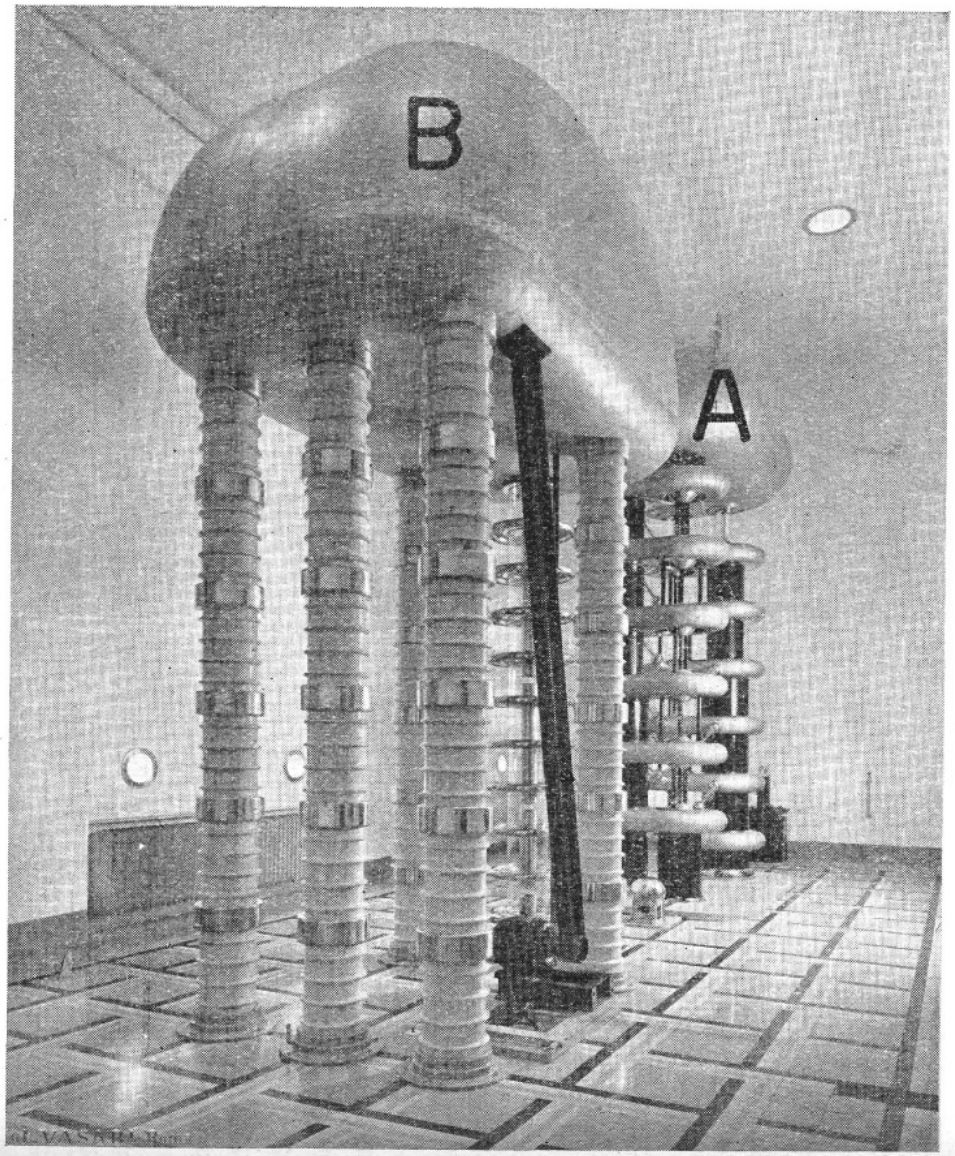


Fig. 3

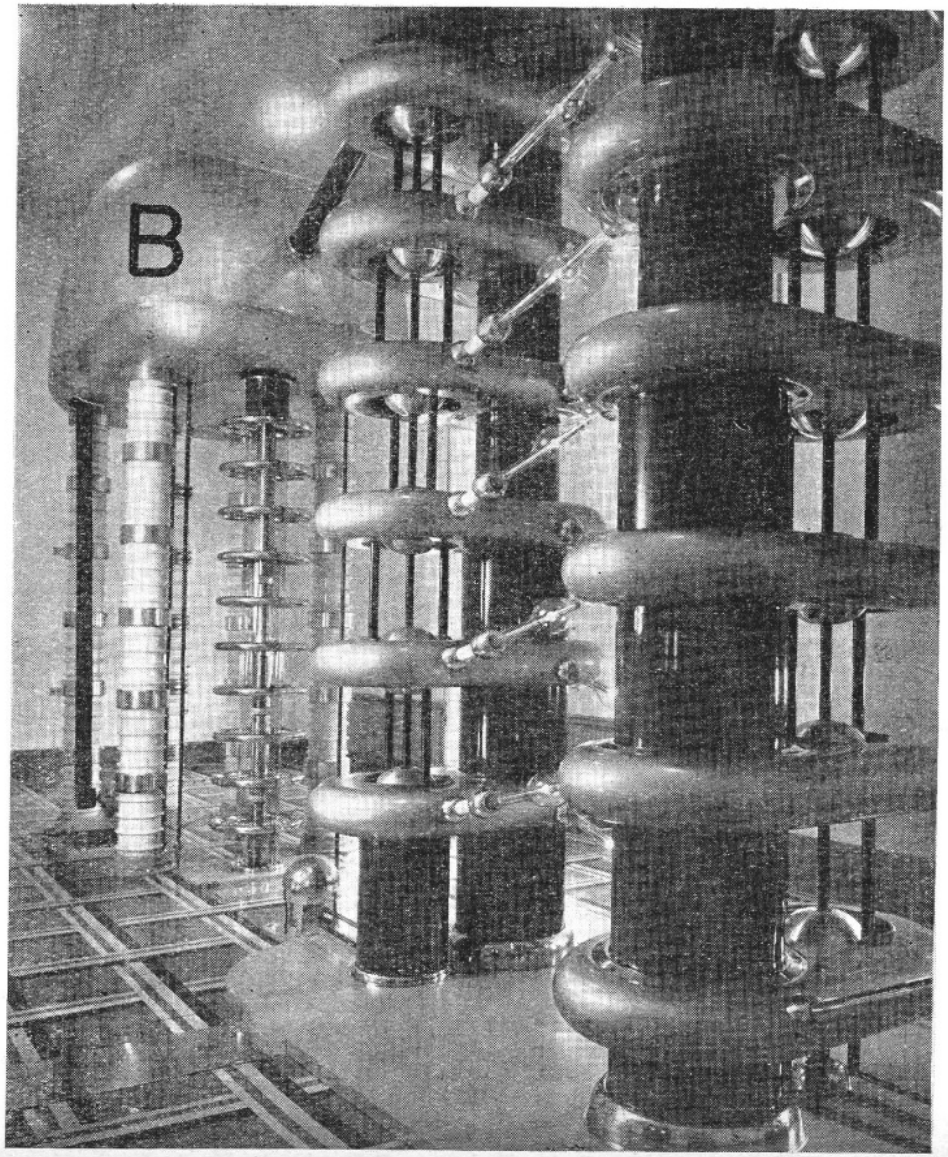


Fig. 4

1.1 MeV Cockroft-Walton accelerator at the Istituto Superiore di Sanità (now rebuilt at the INFN national lab in Frascati)

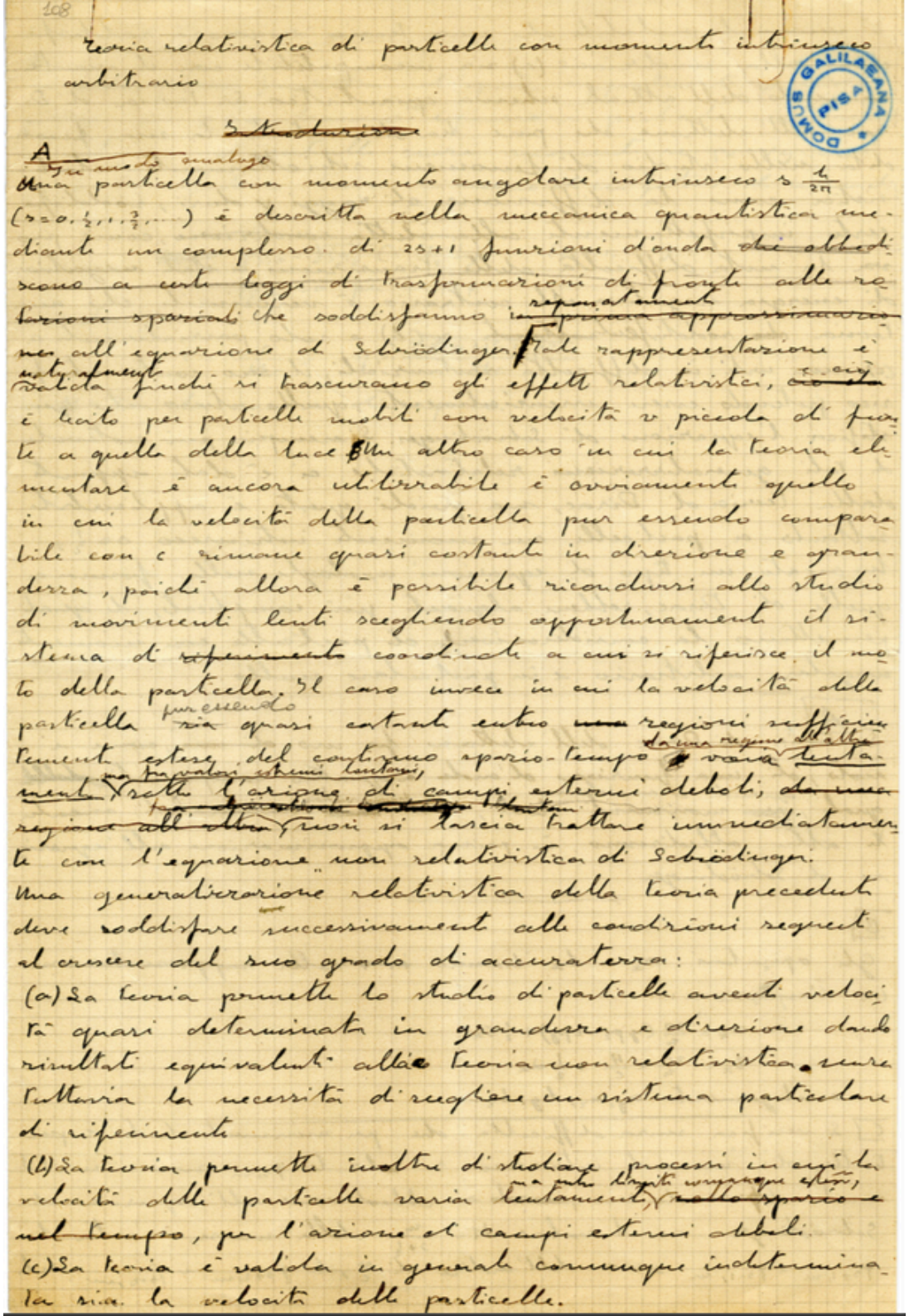
ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

- As regards **Majorana**, we carried out the reconstruction of its scientific-methodological approach of his researches in the field of **relativistic wave equations** which led him to the formulation of the symmetric theory of electron and positron (1937).

CENTRO FERMI
Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi

A **handwritten page** – result of a painful drafting – of **Majorana's paper "Teoria relativistica di particelle con momento intrinseco arbitrario"**, *Nuovo Cimento* 9, 335-344 (1932). In controversy with Paul Dirac, Majorana finds quantum relativistic wave equations that have no negative energy states. This is a remarkable discovery, fully recognized by Eugene Wigner.



ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Project main goals and results achieved in 2019

- **Results achieved in 2019**:
  - For what concerns the forced emigration to the United States, at the end of the 1930s, of many Italian physicists, we have analysed, on the basis of **new documents (recently available** thanks to the opening to consultation of the Segrè Archive at the Bancroft Library of the University of Berkeley), the complex reasons that in 1938-1940 led **the three maximums Italian experts in Nuclear Physics – Emilio Segrè, Enrico Fermi and Bruno Pontecorvo – definitively leave Italy to emigrate to the United States**.

CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Emilio Segrè, Enrico Fermi, Bruno Rossi, Bruno Pontecorvo: a new **network of solidarity for survival**

Another “forced migrant”: Picture taken by **Bruno Rossi on** the **ship that brought him to America**, after the enactment of the racial laws.

CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Publications (2019)

- M. Leone, N. Robotti, **I Fisici Senatori: 1848-1943**, SIF, Bologna 2019
- M. Leone, N. Robotti, G. Verna, "Reply to Comment on ''Rutherford's experiment' on alpha particles scattering: the experiment that never was", **Physics Education**, 54, (2019) 066502. DOI: 10.1088/1361-6552/ab38f4
- E. Colombi, F. Guerra, M. Leone, N. Robotti, "The sounds of war: phonotelemetry at the Italian front", **Physics Education**, 54, (2019) 035017. DOI: 10.1088/1361-6552/ab0907
- F. Guerra, M. Leone, N. Robotti, "La prima trasmutazione artificiale del nucleo e la scoperta del protone (Rutherford 1919)", **Giornale di Fisica**, 60:4, (2019)
- E. Colombi, F. Guerra, M. Leone, N. Robotti, "I Fisici Italiani in Guerra: 1915-1918", **Quaderni di Storia della Fisica**, 21:1, (2019), 29-60. ISSN 1594-9974
- M. Leone, N. Robotti , " La trasmutazione degli elementi", **La Chimica e l'Industria online**, III:4, (2019), 26-31. ISSN 2283-544X

CENTRO FERMI
Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Publications (2019)

- N. Robotti, “Trabacchi Giulio Cesare, fisico 1884-1959”, **Dizionario Biografico degli Italiani**, Istituto della Enciclopedia Italiana, Roma 2019
- N. Robotti, “Rutherford e il sogno degli alchimisti”, **Asimmetrie**, 26, (2019) p. 36
- F. Guerra, N. Robotti, “Emilio Segrè, Enrico Fermi, Bruno Pontecorvo verso l'America", **Quaderni di Storia della Fisica**, 22, 127-143 (2019)
- F. Guerra, N. Robotti, “**Enrico Fermi: una vita intensa**", in Enrico Fermi a Firenze, R. Casalbuoni, G. Frosoli, G. Pelosi, eds, Firenze University Press, (2019),
- F. Guerra, N. Robotti, “**Majorana and neutrinos**", in History of the Neutrino, 1930 – 2018, M. Cribier, J. Dumarchez, D. Vignaud, editors, AstroParticle and Cosmology Laboratory (APC), Paris, May 2019
- E. Colombi, "**Le eclissi dal mito alla scienza**", in E. Colombi e M. Pavesi (a cura di), L'eclissi che ha cambiato il mondo, Graphital 2019, pp. 17-23.
- E. Colombi, "**Sir Arthur Stanley Eddington: alla ricerca dell'eclissi**", in E. Colombi e M. Pavesi (a cura di), L'eclissi che ha cambiato il mondo, Graphital 2019, pp. 25-38

CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Conferences (2019)

- N. Robotti, “Chi è davvero Ettore Majorana”, **Convegno “Dinamica Stocastica”, Verona**, 26 Marzo 2019
- N. Robotti, “Donne Chimiche e Fisiche dietro la Tavola Periodica (ignorate ma poi rivalutate)”, **Lions Club Catania Lago di Nicito, Catania**, 12 Aprile 2019
- N. Robotti, “Chi è davvero Ettore Majorana”, **Liceo Classico Nicola Spedalieri, Catania**, 13 Aprile 2019
- N. Robotti, “Dalla costante “h” di Planck al primo atomo quantizzato”, **Scuola Nazionale per Insegnanti sulla Fisica Moderna e la Matematica SNI-FM, 2019, Udine**, 15-19 luglio 2019
- N. Robotti, “I Fisici Senatori 1848—1943”. **Relazione su invito. 105° Congresso Nazionale SIF, L'Aquila**, 23 settembre 2019
- N. Robotti, “ Donne di Scienza: chimiche e fisiche dietro la tavola periodica degli elementi” **Festival della Scienza, Genova**, 3 novembre 2019
- N. Robotti, "Storia della Fisica - Una prospettiva storica all'introduzione della Fisica Moderna: Storia della scoperta dell’elettrone - Storia della scoperta della costante h di Planck - Storia della scoperta del nucleo”, **Università di Verona**, Dipartimento di Informatica, 6 – 11- 28 marzo 2019

CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Conferences (2019)

- F. Guerra, N. Robotti, "Il ruolo di Persico nello sviluppo della fisica delle alte energie", Convegno "Il valore della fisica. Enrico Persico nella cultura italiana del Novecento", **Accademia delle Scienze di Torino**, 3 ottobre 2019
- F. Guerra, "La straordinaria vita di Ettore Majorana", Dipartimento di Matematica e Fisica, **Università di Roma Tre**, 6 febbraio 2019
- F. Guerra, "Werner Heisenberg e la meccanica quantistica", **Scuola per insegnanti SNI-FM19**, Dipartimento di Matematica, Informatica e Fisica, Università di Udine, 19 luglio 2019
- F. Guerra, "Che cosa ha realmente prodotto", Convegno su Ettore Majorana, **Liceo Nicola Spedalieri**, Catania, 13 aprile 2019
- E. Colombi, "Eddington alla ricerca delle eclissi", **Giornata di studi sull'eclissi del 1919, Università di Parma**, 15 novembre 2019
- M. Rinaudo, M. Leone, "The dust catcher: transforming dusty collections of scientific instruments into tools of education", **15th IHPST International Conference, Thessaloniki**, 17 July 2019
- E. Colombi, F. Guerra, M. Leone, N. Robotti, "Aldo Pontremoli: a case-study of interplay between scientific research and civil/military commitment", **1st Conference of the International Academy of the History of Science**, Athens, 12-15 settembre 2019

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Conferences (2019)

- M. Leone, N. Robotti, "Augusto Righi, Senatore del Regno", **105° Congresso Nazionale SIF**, L'Aquila, 23 settembre 2019
- E. Colombi, F. Guerra, M. Leone, N. Robotti, "Aldo Pontremoli al Cavendish Laboratory", **105° Congresso Nazionale SIF**, L'Aquila, 23 settembre 2019
- F. Guerra, N. Robotti, "La scelta del moderatore per la reazione a catena nell'uranio naturale: 1940-1945", **105° Congresso Nazionale SIF**, L'Aquila, 23 settembre 2019
- F. Guerra, N. Robotti, "Ettore Majorana studente liceale", **105° Congresso Nazionale SIF**, L'Aquila, 23 settembre 2019
- M. Leone, N. Robotti, Presentazione del volume "I Fisici Senatori 1848-1943" (con G. Quagliariello, U. Bottazzini, L. Cifarelli, R. Simili, G. Trinchieri), **Biblioteca del Senato, Sala degli Atti Parlamentari**, 13 settembre 2019

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Plan of activities 2020 - 2022

- It is planned the **continuation of the research on the civil commitment of physicists during the Kingdom of Italy (1848-1943)**, with reference to the analysis of specific case studies relating to the legislative activity of the "physicists-senators" and their collaboration with other scientists present, in the same span of time, in Parliament.

CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Plan of activities 2020 - 2022

- Continuation of research on **Aldo Pontremoli**, and in particular on the **intertwining between his scientific activity and civil commitment**. We plan to focus our analysis on:
  - his participation to the **Great War** as an expert on **tethered balloons**
  - his scientific activity at the **Institute of Physics in Rome** (where he graduated and became Corbino's assistant), and to his **relationship with Enrico Fermi and Enrico Persico**
  - his participation to the **1928 Nobile polar expedition** (a kind of anticipation of the PolarquEEEst), where he was victim of the known incident

ACS, Segreteria Particolare del Duce, Carteggio riservato (1922-1943)

***Italia* airship** during the **polar expedition** in May 1928, a few days before the crash **where Aldo Pontremoli and other five crew members lost their lives**

CENTRO FERMI

MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

Aldo Pontremoli (left) and the Swedish meteorologist and explorer **Finn Malmgren** taking magnetic measurements during a stop in Stolp (Northern Poland), in April 1928, en route to the Pole

CENTRO FERMI
MUSEO STORICO DELLA FISICA E CENTRO STUDI E RICERCHE ENRICO FERMI

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Plan of activities 2020 - 2022

- It is planned the reconstruction of the scientific activity of **Giulio Cesare Trabacchi** as a collaborator of **Corbino** in the years 1914-23, and as Director of the **Ufficio del Radio**, from 1923 until 1953, with a particular reference to his roles:
  - **in the discovery of neutron-induced radioactivity** through the development of the **radon extraction plant he built**
  - **in the Nobile's *Italia* airship polar expedition of 1928** (a preliminary research at the State Central Archive has indeed disclosed archival documents about this role)
  - in the research in **nuclear physics in Rome after Fermi's departure**

CENTRO FERMI
Enrico Fermi

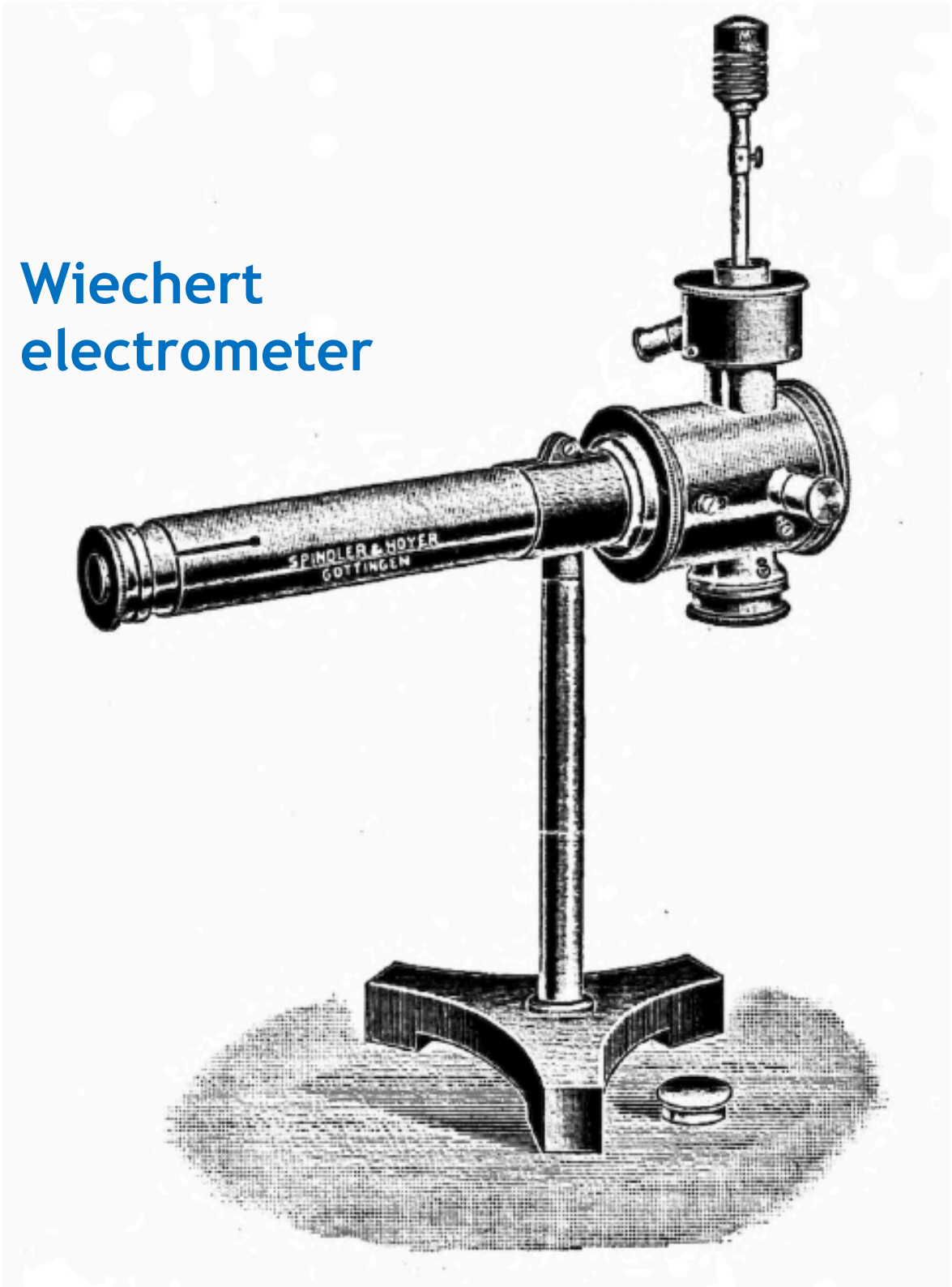
MUSEO
STORICO DELLA FISICA
E
CENTRO
STUDI E RICERCHE
ENRICO FERMI

Wiechert electrometer

In 1928 this instrument was **loaned by Giulio Cesare Trabacchi to Umberto Nobile, to be used in the polar expedition**.

Because of the tragic outcome of the expedition, in 1931 the Ministry of Interior authorized Trabacchi to remove the loaned instrument from the inventory of the laboratory.

The actual fate of the instrument is still uncertain.



ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Plan of activities 2020 - 2022

- Reconstruction of the **role played by Corbino** in 1920s and 1930s physics research in Italy, through the analysis of the scientific activities, and their **intertwining**, carried out **by Enrico Fermi, Enrico Persico and Aldo Pontremoli**, all three initially linked to Corbino and all three winners of the first 1926 theoretical physics competition.

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Plan of activities 2020 - 2022

- Continuation of studies on the **scientific and methodological path followed by Ettore Majorana** in the field of relativistic wave equations which led him to infinite-component wave equations, to the symmetrical theory of the electron and the positron, to the Majorana neutrino and to some applications to the hyperfine structure.

ITALIAN PHYSICISTS BETWEEN SCIENTIFIC RESEARCH AND CIVIL ENGAGEMENT (HISTSEN)

Plan of activities 2020 - 2022

- Continuation of the reconstruction on the activity in **nuclear physics in Rome after Fermi's departure**
- Continuation of the reconstruction on the **forced emigration to the United States, at the end of the 1930s, of many Italian physicists**
  - This specific research will be conducted through numerous archives – already partly exploited – such as the E. Segrè Archive in Berkeley, the E. Fermi Archives in Pisa and Chicago, the B. Rossi Archive in Boston, the B. Pontecorvo Archive in Cambridge, the E. Majorana Archive in Pisa, the E. Amaldi Archive in Rome, the Central State Archive, the Archive of the University of Rome La Sapienza and other Italian university archives

Expected funding in the 2-year period

- Request of funding by Centro Fermi

Expected funding: 45000 € to cover the following costs:

- travel, accomodation, meal for missions in archives, libraries, conferences, etc.
- conference fees
- reproduction rights
- duplication and digitization costs
- publication costs

- Co-funding

Expected 15000 € from University of Genova, Turin, Rome, INFN

- Potential external funding

It is expected the participation as Centro Fermi, if the opportunity occurs, to calls for external fundings