

Storia delle scienze sperimentali. — *Romagnosi and the discovery of electromagnetism.*

Nota di SANDRO STRINGARI e ROBERT R. WILSON, presentata (*) dal Socio L.A. Radicati di Brozolo.

ABSTRACT. — In 1802 Gian Domenico Romagnosi observed in Trento the deviation of the magnetic needle induced by an electric current. Did he anticipate the most famous Oersted's experiment of 1820? Did he ever claim priority in the discovery of electromagnetism? Who was aware of his results? The historical debate on Romagnosi's experiment is reviewed on the basis of documents so far ignored in the literature.

KEY WORDS: History of Electromagnetism; Physics; Gian Domenico Romagnosi.

RIASSUNTO. — *Romagnosi e la scoperta dell'elettromagnetismo.* Nel 1802 Gian Domenico Romagnosi osservò a Trento la deviazione dell'ago magnetico prodotta da una corrente elettrica. Anticipò il famoso esperimento di Oersted del 1820? Rivendicò mai la priorità della scoperta dell'elettromagnetismo? Chi era a conoscenza dei suoi risultati? Il dibattito storico sull'esperimento di Romagnosi viene riproposto sulla base di documenti fino ad ora ignorati nella letteratura.

1. INTRODUCTION

Electricity, a subject with its origins in antiquity, saw its most important development at the end of the nineteenth century, and its application in the twentieth century. Magnetism also comes to us from antiquity especially with the elucidation of Gilbert in his *De Magnete* of 1600. At present we understand that these phenomena are but different manifestations of one comprehensive theory, electromagnetism. Electromagnetism is one of the great discoveries of all time and is basic to the understanding and applications of modern sciences so it is of considerable historic interest to know when it was first realized that electricity and magnetism were not completely separate subjects, but were related.

Hans Christian Oersted (1820) is usually given the credit for the discovery of electromagnetism. In his famous experiment made public in 1820 he showed that a current can interact with a magnet (magnetic compass needle). Moreover he understood the transverse nature of the force generated by the current flowing in the wire.

However, it is strange that an Italian jurist and amateur physicist, Gian Domenico Romagnosi, had made a similar discovery eighteen years before. Why did Oersted get so much credit for his much later discovery, while Romagnosi prior discovery has been nearly forgotten? Several authors of the XIX century investigated the problem and raised a series of questions:

a) What did Romagnosi really observe in 1802?

(*) Nella seduta del 12 novembre 1999.

b) Should Romagnosi rather than Oersted be considered the discoverer of electromagnetism?

c) What other people knew of this work, and when?

d) Did Romagnosi ever claim priority in the discovery of electromagnetism after the publication of the Oersted's paper?

Almost 200 years after the Romagnosi's experiment the above questions have received only a partial and unsatisfactory answer. In his book Dibner (1962) presented a discussion of Romagnosi's experiment and of the literature on the subject. The main conclusion can be summarized as «Romagnosi came close, but failed, to discover electromagnetism».

It is worth noting that all the authors who investigated the problem, including Dibner, based their analysis and conclusions on the paper published by Romagnosi (3 agosto 1802) on the *Gazzetta di Trento*. The purpose of the present work is to discuss the historical debate on the Romagnosi's experiment on the basis of other documents so far practically ignored in the literature. These include:

- A second paper written by Romagnosi (13 agosto 1802) and published on the *Gazzetta di Rovereto*. With respect to the article of the *Gazzetta di Trento* this second paper contains more information on the experiment carried out in Trento.
- The proof that Romagnosi, in October 1802, sent his paper to Paris (Académie des Sciences, 1802).
- A private letter written by Romagnosi in 1827 (Fermi, 1935), commenting on Oersted's experiment and claiming priority in the discovery of electromagnetism.

2. HISTORICAL REVIEW

2a. Romagnosi «Physicien De Trente».

Let us first recall briefly that electric and magnetic phenomena had been known since ancient times but that the studies of the physiologist Luigi Galvani, concerning what he called animal electricity were announced in 1791 and that Alessandro Volta had developed by 1800 a cell (like a modern battery cell) capable of producing a substantial electric current in a wire connected between its electrodes.

Within a few years Romagnosi had speculated about the possibility of there being an interaction between the voltaic current and a magnetic compass needle. In the month of May 1802 he completed in Trento the experiment in which he observed the deviation of the magnetic needle. He published the results on August 1802 in two papers appeared on local journals. The first one (Romagnosi, 3 agosto 1802) was published in the journal *Ristretto dei Foglietti Universali* (usually referred to as *Gazzetta di Trento*). This paper (fig. 1) became rather popular after Oersted's discovery and its text was reported by many authors of the XIX and XX century.

A few days later, on August 13, a longer paper (Romagnosi, 13 agosto 1802) appeared in the journal *Notizie Universali* (usually referred to as *Gazzetta di Rovereto*) (fig. 2a, b, c).

NUM. LXV.

NOTIZIE UNIVERSALI.

Venerdì 13 Agosto 1802.

VIENNA 4 Agosto.

SUA Maestà l'Imperadore si è degnato di accordare audienza questa mattina a Monsignor Arezzo Arcivescovo di Seleucia, che è qui di passaggio, e che come Ambasciatore straordinario della Sede Pontificia si porta alla Corte Imp. Russa. A' 29 Luglio gli Stati del Regno d'Ungheria radunati in Presburgo, e in particolare quelli dei Distretti del Tibisco e del Danubio, hanno tenuto delle sessioni circolari.

Dalla GERMANIA.

Lettere particolari di Parigi parlano di alcune modificazioni nel piano d'indennizzazione a favore della Casa d'Autria, intorno alle quali si è, come si assicura, attualmente in negoziazioni a Parigi, e che concernono tra l'altro lo stabilimento futuro dell'Arcid. Antonio eletto Elettore ed Arcivescovo di Colonia, e Principe - Vescovo di Münster. — Rapporto alla quistione se le secolarizzazioni debbano tirar dietro se anche la total soppressione dei voti degli Stati Ecclesiastici alla Dieta dell'Impero, si vuole attualmente sapere, che, in sequela delle convenzioni concluse, quei Principi Ereditarij ai quali tocca la sovranità dei singoli Stati Ecclesiastici, otterranno pur anche i voti dei medesimi alla Dieta nel tempo stesso che d'altra parte tutti quei voti verranno soppressi, che spettano ai Paesi situati sulla sponda sinistra del Reno: che all'incontro anche gli Elettori e Principi Ecclesiastici spogliati, ed ai quali almeno fino ad ulterior disposizione non vengono tolti i lor diritti metropolitani e diocesani, conserveranno in avvenire una certa specie di diritti d'uno Stato dell'Impero, mentre essi, come fin ad ora i Conti, e i Prelati, avranno alcuni voti nella Camera dei Principi. Verranno pure uniti alla Camera dei Principi i voti delle Città Imperiali che verranno conservate, mentre all'incontro il Collegio delle Città Imperiali verrà soppresso interamente alla Dieta; in conseguenza non considererà la medesima in avvenire che in due Collegi, quello degli Elettori, e dei Principi. Tutto ciò è stabilito provvisoriamente, come si sente, negli articoli addizionali della convenzione di Parigi: deve però esser presentato alla Deputazione dell'Impero e alla Dieta soltanto dopo che saran terminati gli affari delle indennizzazioni. Le negoziazioni par-

ticolari tra i singoli Principi dell'Alemagna, le di cui indennizzazioni sono già interamente in netto, sono in parte, come si sente, incamminate, nominatamente tra la Baviera e Orange, Baden e Darmstadt, Sassonia e Brandemburgo. Queste negoziazioni hanno rapporto al cambio di quello, o quell'altro Stato. Il Ministro Sassone in Parigi deve aver fatte delle rappresentanze riguardo ai Distretti Magonzesi nel Circolo della Sassonia superiore, specialmente alla Città di Ehrfurt, dati alla Prussia. Questi reclami devono aver dato luogo alle suddette negoziazioni.

MÜNSTER 27 Luglio.

Nell'imminente occupazione delle Truppe Prussiane del nostro Paese è stato rilasciato da questo Capitolo Reggente il seguente Proclama. „ Nel reggere questo Vescovado il Capitolo si propone per unico scopo delle sue cure la felicità di ciascun suddito. Quindi non dubita, che nessuno degli abitanti del Paese ciò non riconoscerà, e quindi non porrà una confidenza illimitata ne' suoi ordini, e nelle sue aspettative. Di ciò il Capitolo pienamente convinto ordina ad ogni suddito di qualunque stato egli sia di contenersi tranquillo all'entrata delle Truppe Reali Prussiane, di trattare opportunamente i soldati acquarterati, e di ajutarli quando abbisognino, del suo ajuto e della sua assistenza; di astenersi ne' suoi discorsi da qualunque politica osservazione, e di non voler procurarsi da se stesso giustizia nelle beghe che potessero nascer tra lui e i soldati, ma di far presenti sul momento con ogni verità i suoi gravami alla superiorità del luogo, od in mancanza di questa all'Uffiziale Comandante il luogo, di uniformarsi alle decisioni di questo, e qualora non gli sembrassero giuste di farle presenti a un Uffiziale di grado superiore; in qualunque caso però di omettere qualunque atto dispotico. Solo seguendo esattamente questi ordini goderà il suddito e tranquillità e pace, e operando al contrario avrà ad attendere castighi dalla Superiorità sua. Nel tempo stesso che il Capitolo Reggente mossa dal dovere, e dall'amore per questi abitanti rende pubblica questa misura, d'altra parte non mancherà anche d'invigilare con sempre maggior cura per la vera e permanente felicità dei sudditi. Acciocchè il presente per-

stanze della sua prima nominaggl'imponeffer: il dovere di non accettare quella rielezione prima che il Popolo Francese col suo voto non avesse dato una prova del suo attaccamento, e della sua confidenza verso il primo Magistrato, che fu l'oggetto della sua prima elezione. In questa situazione credemmo di dover interamente elairire il pensiero del Senato. Il Popolo Francese ha risposto: quasicchè da tutti i Dipartimenti sono pervenuti alla Reggenza i documenti che contengono l'espressione del suo volere. E' nostra opinione, che in questa nuova circostanza spetti al Senato e l'estrarre, e il pubblicare il voto del Popolo. Noi abbiamo ordinato al Ministro dell'Interno di trammettergl' i registri che contengono il voto nazionale. Noi invitiamo il Senato di prendere nella sua saggezza quelle misure che gli sembreranno più adatte per autenticare il risultato." *Il secondo Consiglio* (segnato) *Cambreses*.

MAURID 15 Luglio.

Il dì 6 corrente l'Ambasciatore della Corte di Napoli fece in nome del Re suo Sovrano la dimanda della R. Infanta Donna Maria Isabella in sposa del Real Principe Ereditario di Napoli. Quell'atto fu accettato con gradimento da S. M. Cattolica, e ne fu preso registro secondo le consuete formalità. Per quest'avvenimento vi fu gala sfarzosa a Corte, la Città fu per tre sere illuminata a giorno, e vi furono altre feste. S. M. si è inoltre degnata di fare molte graziose promozioni, come di accordare alcune grazie speciali. Le ultime nuove di Cartagena portano, che la R. Squadra composta di 12 Vascelli, che dee trasferirsi a Napoli per prendere que' Regnanti, trovasi del tutto pronta, e che si metterà alla vela circa ai 15 d' Agosto.

ROMA 31 Luglio.

Sentiamo con dispiacere che i Corsari Barbareschi continuano ad infestare le nostre acque, come pure scorrono verso le spiagge limitrofe. Ultimamente all'altura di Gaeta predaiono 4 Legni Napoletani carichi specialmente d'olio. Similmente fu da essi predata nelle vicinanze di Monte Circeo un Legno Mercantile Portoghese carico di Droghe e di altre merci. L'equipaggio composto di 30 uomini volendo salvarsi da un male ne incontrò un maggiore, poichè gettatosi tutto in mare 28 di loro perirono miseramente annegati, e 2 soli si salvarono, uno de' quali Portoghese, che col fortunato compagno è giunto in questa Capitale.

LAVORNO 30 Luglio.

Si pretende, che per il 18 venturo le LL. MM. il Re e la Regina d'Etruria s'imbarcheranno sopra Legni Spagnuoli che

li trasporteranno a Barcellona per assistere alle feste che si faranno per quelle doppie Nozze Reali. Diceasi che la Maestà del Re lascerà in tempo di sua lontananza una Reggenza al governo del Regno. Con gli ultimi riccontri venuti da Porto - Ferrajo sappiamo, che nel dì 24 giunse in quel Porto una Fregata Francese con diversi altri Bastimenti, che vennero spediti in varie parti dell'Isola, cioè Longone, Marsiana ec. Il Comandante della Fregata consegnò un dispaccio al General Raica, e disse a terra altro General Francese. Nella seguente mattina poi furono presi in Porto - Ferrajo 12 individui di diverse famiglie in qualità di ostaggi. Indi fatta una numerosa requisizione di Marinaj e di altre persone, furono tutti imbarcati con gli ostaggi sulla detta Fregata. Lo stesso fu praticato negli altri suddetti luoghi, dopo di che tutti i Bastimenti col loro imbarco si posero alla vela, diceasi alla volta di Tolone.

BOLOGNA 6 Agosto.

Continuando sempre questa Municipalità nel forte suo impegno d'impedire il monopolio sempre nascente a danni della popolazione, ha con nuovi proclami rinnovare e stabilite sagge misure che riguardano la vendita e la compra dei vittuali sulla pubblica piazza, la vendita e la compra del frumento e del vino. Il popolo spera di vederli immancabilmente osservati mercè lo zelo patrio della detta Municipalità, e della Delegazione d'annoia assistita dalla benemerita Guardia Nazionale.

MILANO 7 Agosto.

Il primo Console Presidente della nostra Repubblica ha accettata la nomina di Membro dell'Accademia militare; così ha egli consacrato la di lei esistenza, ed incoraggiato il suo zelo, e la sua attività. — Il Vice - Presidente assicurò la Repubblica Elvetica di voler consolidare sempre più la buon'amicizia che si ritrova felicemente stabilita fra i due Governi. — La Consulta di Stato riconoscendo l'impossibilità, che tutti gli arrestati vagabondi, facinorosi, e prevenuti di grassazioni, affassinj, violenti furti, subiscano il dovuto esame nel termine legale, ha autorizzato il Governo a prolungare l'arresto de' medesimi fino ad un altro mese.

V A R I E T À .

ARTICOLO SUL GALVANISMO.

Il Signor Consigliere *Gian Domenico Romagnosi*, che dimora in Trento, noto alla Repubb. Letteraria per altre sue profonde produzioni, si affretta di comunicare ai Fisici dell'Europa uno sperimento relativo al fluido galvanico applicato al Magnetismo.

Pre-

Preparata la pila del Sig. Volta composta di piastrelle rotonde di rame, e zinco alternate con un frapporto interfizio di flanella umettata con acqua impregnata di una soluzione di Sale Ammoniacco, attaccò alla pila medesima un filo di argento snodato a diversi intervalli a modo di catena. L'ultima articolazione di detta catena purlava per un tubo di vetro, dall'estremità esteriore del quale sporgeva un bottone pure d'argento unito alla detta catena.

Ciò fatto prese un ago calamitato ordinario fatto a modo di bussola nautica incastrato in mezzo d'un asse di legno quadrato, e levatone il cristallo che lo copriva, lo pose sopra d'un isolatore di vetro, in vicinanza della pila suddetta.

Dato indi di piglio alla catena di argento, e presa pel tubo di vetro suddetto ne applicò l'estremità o bottone all'ago magnetico, e tenutala a contatto per lo spazio di pochi secondi, fece divergere l'ago dalla direzione polare per alcuni gradi. Levata la catena di argento l'ago rimase fermo nella direzione divergente a lui data. Di nuovo applicò la medesima catena, facendo divergere vieppiù il detto ago dalla direzione polare, ed ottenne sempre, che l'ago rimaneva nel luogo, in cui lo aveva lasciato, di modo che la polarità rimaneva interamente ammortizzata. Per verificare poi vieppiù questo risultato egli avvicinò all'ago calamitato alla massima vicinanza possibile (senza però toccarlo) ora un pezzo di molla da orologio, ed ora altri frammenti di ferro, i quali dapprima attraevano fortemente l'ago medesimo ad una distanza quattro volte maggiore; ma essi sotto l'azione del galvanismo non ebbero attività di farlo muovere nemmeno di un pelo.

Affinchè però l'esperimento riesca, conviene avere le seguenti avvertenze: che non tutte le Pile galvaniche sono acconcie ad ottenere l'intento, ma solamente quelle le di cui piastrelle abbiano per lo meno una grossa linea di grossezza e due pollici circa di diametro: che convien far uso della Pila isolata, e poco tempo dopo che fu posta in attività affine di prevenire la troppo pronta ossidazione, che sopravviene alla superficie delle piastrelle: che conviene in ogni caso tener le catene sospese in gualta che non tocchino alcun corpo usferente, e però maneggiarle col tubo di vetro: talvolta affinchè lo sperimento riesce più prontamente convien toccare con ambo i bottoni la punta dell'ago, e poi con uno di questi farlo divergere; non dimenticando anche prima di ciò di maneggiare colla sola mano le catenelle per eccitare la macchina, mentre si prova

che la corrente del fluido galvanico fosse spesso delle interruzioni.

L'ago di cui fece uso il Sig. Romagnosi appena giungeva ad un pollice di lunghezza e ad una linea di larghezza nella massima sua estensione vicino al perno. Egli era composto d'un pezzetto di molla da orologio ben equilibrato e mobile su d'un perno pure di acciaio.

Per ripristinare poi la polarità ecco come il Signor Romagnosi operò. Con ambe le mani strinse fra il pollice e l'indice l'estremità della cassetta di legno isolata senza scuoterla, e la ritenne così per alcuni secondi. Allora si vide l'ago calamitato muoversi lentamente, e ripigliare la polarità non tutto ad un tratto, ma per successive pulsazioni a somiglianza d'una sfera da Orologio destinata a segnare i minuti secondi.

Sottomesso indi l'ago stesso all'azione dell'Elettricità tanto vitrea quanto resinosa facendo uso d'una cannetta di vetro e di cera Spagna strofinata, si videro i seguenti risultati. L'ago veniva attratto fortemente, ed in distanza dalle cannette elettrizzate, dovèchè col bottone della catena galvanica rimaneva fermo. Scoffate le dette cannette, ritornava alla sua primitiva direzione polare, mentre nell'azione del galvanismo rimaneva fermo nella comunicata divergenza. L'azione magnetica d'un ferro che sotto l'azione galvanica non era atta a vincere l'ammortizzazione, prevaleva all'attuale vivace attrazione contraria dell'elettricità che contemporaneamente si faceva agire.

Questa esperienza fu fatta nel mese di Maggio, e fu ripetuta alla presenza di alcuni spettatori. In tale circostanza ottenne pure senza fatica l'attrazione elettrica ad una sensibilissima distanza. Egli fece uso d'un sottile filo di refe bagnato nell'acqua peggna di sale ammoniacco, e lo raccomandò ad una cannetta di vetro, approssimò indi la catena d'argento suddetta al filo a distanza d'una linea circa, e vide il filo volare a combaciarsi col bottone della catena, ed a volgersi in su sempre attaccato come nelle esperienze elettriche.

Il Sig. Romagnosi crede di suo dovere di pubblicare questa esperienza, che deve formar corpo con altre in una Memoria ch'egli sta componendo sul Galvanismo, e la Elettricità, nella quale si riserva di dar la relazione d'un fenomeno atmosferico, che ogni anno accade in un luogo del Tirolo vicino al Preiner, e che affetta fortemente un'intera popolazione, e le fa provare tutti gli effetti del galvanismo.

Di Trento 3 Agosto 1802.

IN ROVEREDO, Per Luigi Marchesani Stampatore Imp. Reg.

The existence of the Rovereto paper was mentioned for the first time in a letter written by Romagnosi to his friend Bramieri at the end of 1802: «I have recently published in the *Gazzetta di Rovereto* a discovery of mine on the effects of the galvanic current on magnetism» (Fermi, 1935). Several authors of the XIX century quoted the Rovereto paper. However the corresponding text has never been reported so far and, in some cases, the quotation has been confused with the one of the Trento paper. This is the case, for example of Govi's paper (Govi, 1869) which had an important influence on the subsequent literature. The main statement contained in the first paragraph of both the Trento and Rovereto papers is that there is an effect of the galvanic current on magnetism. The Rovereto paper contains more details as we will discuss in Section 3.

In 1802 Romagnosi sent a copy of his work to the Académie des Sciences (1802) in Paris (fig. 3). Napoleon had established in 1801 an annual prize (*Prix de Galvanisme*) to support relevant discoveries in electricity and galvanism. The paper was forwarded to the Committee but, unfortunately, no report was made.

In October 1802 Racagni, an Italian physicist from Milan, informed Alessandro Volta that he had not found the effects of the current on the magnetic needle described by Romagnosi (*Epistolario di Alessandro Volta*, 1953: vol. IV, n. 1302). Actually Racagni did not repeat the Romagnosi's experiment, but he used the magnetic needle to close the circuit, like in the Mojon experiment (for a description of Mojon's experiment see Dibner, 1962).

At the end of 1802 Romagnosi moved to the University of Parma. This was a crucial change in his life and the beginning of new professional interests after a period of ten years spent in Trento.

Aldini (1804) and Izarn (1804) published in Paris two books on galvanism where the Romagnosi's experiment is explicitly mentioned (Aldini (p. 340): «M. Romanesi, physicien de Trente, a reconnu que le galvanisme fait déclinier l'aiguille aimentée»; Izarn (p. 120): «D'après les observations de Romanesi, physicien de Trente, l'aiguille aimentée, et que l'on soumet ainsi au courant galvanique, éprouve une déclinaison»).

In the same year Amoretti (1804: p. 201), commenting on a recent discovery by Ritter on Galvanism, quoted the Romagnosi's paper published in the *Gazzetta di Rovereto*. The comment by Amoretti was not however noticed, differently from the ones by Aldini and Izarn which were later reported by several authors.

2b. Romagnosi and Oersted.

In 1820 the attention of the world was attracted by Oersted's discovery carried out in Copenhagen. The Oersted paper (1820), originally written in Latin, was immediately translated in all the European languages and had a crucial impact on the scientific community. Configliachi (1820), after translating into Italian the paper by Oersted, published a comment on Romagnosi's experiment. From this comment we learn that in 1808 Romagnosi communicated with Configliachi that in the experiment of 1802 the magnetic needle did not close the circuit between the two poles of the pile. This clarifies the difference between Romagnosi and Mojon experiments.

A few years later, Silvestro Gherardi, in the Italian translation of the book written by G.F. Demonferrand (Gherardi, 1824), commenting on Mojon and Romagnosi's experiments, concluded that these experiences had nothing that could have influenced Oersted. In his comment Gherardi however identifies the two experiments.

In 1827 Antinori and Libri pointed out the important contribution to the discovery of electromagnetism made by the Italian scientists Mojon and Romagnosi. In the same year the text of the *Gazzetta di Trento* was republished in the journal *Antologia* di Firenze (Libri, 1827). This publication was later used by most of subsequent authors. In the same year Romagnosi sent a letter to Libri, confirming that in 1802 he saw almost the same effects later observed by Oersted (fig. 4).

The Romagnosi's experiment is mentioned by Oersted only in 1830. In a long article published on the *Edinburgh Encyclopedia* (Oersted, 1830) he presented a history of electromagnetism. He says (p. 575): «... Aldini mentions, at the same time, that a certain Mr. Romanesi at Trent had confirmed the experiment of Mojon and that at the same time observed that galvanism makes the magnetic needle deviate. Professor Aldini, whose work upon galvanism comprehends two volumes, does not say a word more upon this subject. It is, therefore, not surprising, that neither the French institute, nor the learned societies, nor the numerous natural philosophers, to which the work was presented in the year 1804, took any notice of this observation, which would have accelerated the discovery of electromagnetism by sixteen years. Romanesi seems likewise to have forgot his observation, until electromagnetism was discovered».

The comment on the *Encyclopedia* gives some merit to Romagnosi («the notice of his observation would have accelerated the discovery of electromagnetism»). On the other hand Oersted gives the impression of ignoring the text of Romagnosi's paper. Oersted also says that Romagnosi's work was presented to the Institut de France in 1804. We now have the proof that Romagnosi sent his paper to Paris two years earlier, in October 1802.

2c. *After Romagnosi's death.*

After Romagnosi's death in 1835 there was a revival of interest in his activity.

In 1835 Cesare Cantù, collaborator and friend of Romagnosi, wrote a book (Cantù, 1835) which reports the Trento paper, erroneously quoted as *Gazzetta di Rovereto* (the confusion between the two papers continues until the present days). Cantù says (at p. 11) that Romagnosi: «never abandoned the studies of electromagnetism, as confirmed by his manuscripts».

In 1839 the name of Romagnosi was quoted in a pamphlet by Francesco Zantedeschi (1839), an abbot from Venice, author of many papers on electromagnetism.

Giuseppe Belli (1840), replying to the Zantedeschi pamphlet, discussed in detail the nature of the experiment. According to Belli this experiment was of electrostatic nature and the deviation of the needle could not be due to the current since the circuit was open during the experiment.

The debate on Romagnosi's experiment was renewed by a long paper by Zantedeschi (1859) who tried to prove that Romagnosi should be considered the discoverer of

Prezioso signore

+ 30 agosto
 prossima passata

Nel ieri ho ricevuto nella mia villeggiatura
 il foglio al quale ~~la comunicazione~~ ^{il} D. S. ci compiacque di som-
 municarmi l'avvenimento della notizia da lei fatta
 inserire nell'antologia ^{circa la} ~~ricevuta~~ scoperta da
 me fatta fine del 1802 intorno alla elettro-cha-
 gnetismo. Punto non mi dole l'ommissione
 critica nessuna dal Sig. Professor Garzanti, né
 punto mi dole se quell'articolo (che fu stato
 dall'amicizia del ^{abate} Tanarini Professor di
 belle lettere e che fu ^{maestro} ~~regimentario~~ dello spedimento)
 fosse stato composto da me. Il applaudisco alla
 sana critica e so tollerare anche l'adverso non san-
 rebbe necessaria. Il pubblico quale essere indol-
 gente tutte le volte che la sostanza delle cose sia
 vera ed interessante, anzi egli solo ributtare come
 pedantesco o obliare le ^{risorse} ~~scoperte~~ di costui, quindi
 non credono di rendersi interessanti ^{che alle sempre} ~~che talora~~
 no!

Oltre ciò ~~avrei~~ ^{avrei} avvisi di fare a voi
 cose grate comunicandole la prova di
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 pag. 106 del no. LXXVII maggio
 1807 dell'antologia. ~~all'abate~~
~~nel tempo stesso la mia gratitudine.~~

non aspirando né
 primo né poco all'onore dover
 chi' opera

Io non mi sarei curato nemmeno di comunicare
 quell'articolo a voi se ^{non mi fosse creduto} ~~la comunicazione~~ non fosse
 stata di parte la cui in dovere di giustificare una not-
 zia verbale data al Professor Capinelli, e che a lui pa-
 rve di render pubblica sulla sua parola. Il ^{con} ~~senza~~ documento
 pubblico è divulgato come quello che a lui ho comunicato
 mi garantisce la ^{v. d. e. me} ~~mia~~ ^{espressione} ~~scoperta~~, e ciò mi basta senza
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 potrebbe convenire qualche particolare ^{responsabile} ~~responsabile~~ ^{che}
 essendo io stato che semplice amatore e non professore
 delle cose fisiche, ^{alla} ~~la~~ ^{maniera} ~~scopo~~ ^{della} ~~scoperta~~
~~essendo~~ ~~dentro~~ ~~all'amicizia~~ ~~abate~~ non so vedere quale
 obbligo ^{essenziale} ~~essenziale~~ di deporre esperienza e riserbarla

electromagnetism and that he also, indirectly, anticipated the idea of the telegraph. The paper is written in a very nationalistic style, but contains some interesting comments. In particular Zantedeschi says that he repeated Romagnosi's experiment, confirming all the results. From the paper we also learn that in 1845 Zantedeschi wrote a letter to Oersted. Zantedeschi sent his pamphlet also to Paris both to the journal *Cosmos* and to the Académie des Sciences. The journal *Cosmos* refused the Zantedeschi thesis (*Cosmos*, 1859), while the Académie des Sciences never discussed the problem (Académie des Sciences, 1860, p. 105). The paper by Zantedeschi was translated into German in the same year in Erlangen (Erlenmeyer and Lewinstein, 1859). This paper contains the first translation of the text of the *Gazzetta di Trento* into a foreign language.

In the same year, in England, J.J. Hamel wrote a long pamphlet on the history of the telegraph (Hamel, 1859). The paper contains explicit comments in favour of Romagnosi as pioneer in the discovery of electromagnetism: «I cannot forego stating my belief that Oersted knew of Romagnosi's discovery, announced in 1802, which was eighteen years before the publication of his (Oersted) own observations. It was mentioned in Aldini's book ... Who would suppose that Oersted did not know everything contained in Aldini's book, in which even the index points to Romagnosi's discovery in the following words: Romanesi a fait des tentatives sur l'aiguille aimantée? ... As Oersted must have known Romagnosi's experiment it would have been an additional credit to him if in 1819 and 1820, on making known his own observation, he had just said a word about Romagnosi as pioneer in the field on which he became loaded with laurels ... ».

The Hamel paper was commented by W.F. Cooke (see Hamel, 1859), one of the inventors of the telegraph, who confirmed the relevance of the following dates:

- 1809, 8 July *Soemmering invented his plan for telegraphing by evolution of gas.*
- 1810, 13 August *Showed it to Baron Schilling at Munich.*
- 1802 May *Giandomenico Romagnosi discovered that the magnetic needle was deflected by galvanic currents, and in August in the same year published the discovery at Trent.*
- 1812 *Baron Schilling's operations with a subaqueous galvanic conducting cord, through river Neva, at St. Petersburg.*
- 1815, 3 August *Baron Schilling communicated to Soemmering the «Manuel du Galvanisme» a book printed in Paris in 1805 mentioning the Romagnosi's discovery. Baron Schilling may, therefore, be supposed to have known from this date the fact, that a galvanic current deflected a magnetic needle; although Dr. Hamel comes to the conclusion that neither Soemmering, or Schilling had any idea of a practical application of Romagnosi's discovery until 1825 or 1826, five years after Ampere's suggestion.*

A few years later the Romagnosi's experiment was quoted by Poggendorff (1863).

In 1867 Cromewell Fleetwood Varley, eminent member of the Electrical Telegraph Company, sent a letter to the Editor of *The Reader* (Varley, 1867) commenting on the

history of the telegraph and on the work by Romagnosi: «In the year 1802 Romagnosi discovered (and published the fact in Paris in 1804) that when a magnetised needle is submitted to the action of a galvanic current, it is deflected. In 1819 Oersted drew more particular attention to this fact and from it resulted the galvanometer and the electro-magnet».

Gilberto Govi (1869) wrote a long article in which, repeating and completing the arguments by Belli, concluded that Romagnosi's experiment had nothing to do with the Oersted one and that Romagnosi himself never claimed his priority. The Govi paper had an important impact in the subsequent literature.

Other comments on Romagnosi's experiment can be found in the *Catalogue* of the Sir Ronalds Collection, published in London (Ronalds, 1880), and in a short letter by Tommasi (juin 1883) who asked the Committee for the Vienna Exposition of Electricity to discuss the question of the priority of the discovery of electromagnetism.

Fahie (1884) in his book on the history of electric telegraphy reported the Trento paper and, following the Govi arguments, reached the conclusion that the Romagnosi's experiment had nothing to do with the Oersted one. Like Govi, Fahie also emphasized the silence of Romagnosi after the Oersted's discovery as: «another, and to us convincing, argument against the supposition that Romagnosi had any share in the discovery of electromagnetism».

Additional comments on the Romagnosi's experiment are contained in other papers and books written both in the XIX century and at the beginning of the XX century. Among them it is worth mentioning the pamphlets by Ciscato (1882) and Menestrina (1909) concerning the Romagnosi's stay in Trento.

2.d. *The more recent literature.*

Appleyard (1930) discussed in a rather extensive way the Romagnosi's paper published in the *Gazzetta di Trento*, and in particular the question of priority with respect to Oersted. He reports the full text of the paper and finally says: «From this evidence it is manifest that Romagnosi was concerned solely with an effect of electrical discharges through the magnets themselves, and that he repeated, in effect, the experiment of Mojon, by sending a more or less continuous current through the magnets. As his magnets were fixed, he did not observe the rotary movement that was the essence of the Oersted's discovery. Moreover, Romagnosi himself made no claim to such a discovery ... ».

In 1935 S. Fantoni collected a series of unpublished letters by Romagnosi (see Fermi, 1935). They include in particular the letter written by Romagnosi to Libri in 1827, in which Romagnosi claimed priority in the discovery of electromagnetism. It is interesting to note that this letter was unknown to all the preceding authors.

More recent comments on Romagnosi's experiment are contained in biography of Joseph Henry by Thomas Coulson (1950), who explicitly emphasizes the role of Romagnosi as pioneer in the discovery of electromagnetism, and in a Russian paper by Olga Lezhnova (1959), who concludes that the body of Romagnosi might have closed

the circuit, but that Romagnosi did not discuss the experiment in terms of a current passing through a closed circuit and that consequently he can not be considered the discoverer of electromagnetism.

Dibner (1962), in the already mentioned book on Oersted, summarizes the historical debate on Romagnosi's experiment.

Edoardo Amaldi, in a private letter sent to one of us (RW) in 1966, repeated more or less the same steps of the story and concluded that «the Govi's criticism was probably too severe even if the Romagnosi's experiment was rather dirty». Similar comments are contained in more recent papers by Zavattini and Abbondanno (1993) and by Amoretti (1995).

This historical summary reveals that the Romagnosi's experiment attracted the attention of many authors in both the XIX and XX century. The ambiguity in the description of the experiment and the lack of other documents are probably the main reason why no clear and definitive conclusion on the experiment was drawn and why the credit for the discovery of electromagnetism was given to Oersted whose work, different than Romagnosi's, had a crucial impact on the scientific community and became the starting point of the development of electromagnetism with Ampere, Faraday and the other founders of electromagnetism.

3. «GAZZETTA DI TRENTO» AND «GAZZETTA DI ROVERETO»

Romagnosi published in 1802 two papers on his experiment. The text of the *Gazzetta di Trento* widely circulated among the specialists of history of electromagnetism while the text of the *Gazzetta di Rovereto* was systematically ignored. Some authors quoted it but the text was never reported. The republication of the Rovereto paper then represents a major issue of the present article. In the *Appendix* we give the English translation of both the Trento and Rovereto papers. The translation of the Trento paper is taken from Fahie (1884).

As discussed in the preceding sections the Trento paper was commented by many authors in the past. Among them Belli and Govi raised the following specific criticisms:

- a) According to the description of Romagnosi the circuit was never closed, so that no current could circulate in the experiment, which consequently has nothing to do with Oersted's experiment.
- b) Romagnosi put in touch the knob of the chain with the magnetic needle. This produced a transfer of charge to the needle with consequent electrostatic repulsion, causing the deviation of the needle.

These comments tend to classify the experiment as an electrostatic effect induced by an insulated pole of the pile. However this conclusion is not completely obvious because of the weakness of the electrostatic repulsion.

From the comparison between the two texts one can see that the Rovereto paper contains more details and information on the experiment. First it gives details on the pile that were not known before. Romagnosi also speaks of two chains and two

knobs, of the necessity of using the bare hands in order to excite the machine and avoid the interruption of the current. Furthermore in this paper Romagnosi makes more systematic comparisons with the effects of electricity. Though more stringent conclusions are not easy, we can nevertheless say that:

- according to the communication made by Romagnosi with Configliacchi in 1808, the experiment made in Trento was not a repetition of the Mojon's experiment where the current flowed through the needle;
- it may well be that the Romagnosi's experiment was not (and certainly was not intended to be) of an electrostatic nature, since many comments, especially in the Rovereto paper, directly or indirectly refer to the «Galvanic flow».

4. PRIX DE GALVANISME

In October 1802 Romagnosi submitted his manuscript to the Académie des Sciences. On the «Procès-Verbaux» of the «Séance du 14 Vendémiaire An 11» (6 October 1802) one reads: «M. Romagnesi de Trente en Tyrol, envoie un article imprimé sur le galvanisme. Il est renvoyé à la commission nommée pour ces objets» (see fig. 3). The members of the Committee, elected about one year earlier, were: Laplace, Coulomb, Monge, Charles, Fourcroy, Vauquelin, Halle and Biot. Volta and Brugnatelli were also invited to participate in the Committee. They however left Paris before Romagnosi's submission. To our knowledge the participation of Romagnosi in the *Prix de Galvanisme* had never been pointed out before.

The Committee never wrote a report on Romagnosi's paper. Among the original documents at the Académie des Sciences, there is also a later list of papers and manuscripts on galvanism sent to the Académie. Below the name of Romagnosi an additional comment says: «Le rapport n'a point été fait».

It is interesting to point out a curious coincidence concerning the presence of Oersted in Paris during the same period. Actually Oersted was indirectly involved in the same Prix since a friend of his, the German scientist Ritter, had submitted the results of his discoveries on the storage column a few months later (28 Thermidor an 11). The paper was presented officially to the Académie by Oersted himself who was a strong Ritter's supporter, friend of Biot, and already known for his research activity on galvanism. This is also reported in the autobiography of Oersted (see for example Stauffer, 1953). The Committee for the *Prix de Galvanisme* wrote a long report on October 1803, with extensive comments on the various researches done during the preceding year. Unfortunately this report does not contain any notice on Romagnosi's work. It instead discusses in details Ritter's work, and mentions explicitly the role played by Oersted in supporting it. By reading the report one also understands why the Committee did not assign the prize that year. In fact a few months later Ritter, who was the most favorite candidate, had announced a further much more important discovery: the existence of an electric pole in the earth. His conclusions were not accepted and he consequently failed in obtaining the prize. It is finally interesting to note that the report of the Committee

quotes explicitly Aldini's book, published in Paris the same year, where Romagnosi's experiment is explicitly mentioned.

5. TWO LETTERS BY ROMAGNOSI

In 1935 Stefano Fermi collected almost two hundred letters written by Romagnosi during his life and published them in a volume (Fermi, 1935). Among these letters two documents contain relevant information on the topics of the present investigation. In a letter of 24 July 1827 Romagnosi asked Giovanni Porri to give the enclosed copy of the *Gazzetta di Trento* to Libri who in fact published it a few months later in Florence (Libri, 1827). We have here the proof that the republication of the text in 1827 was stimulated by Romagnosi himself. In this letter Romagnosi also says that it was important to work with the proper size of the pile in order to make the experiment successful.

The second letter was sent by Romagnosi on 20 September 1827 to Guglielmo Libri, Firenze. This document is particularly interesting because Romagnosi compares his experiment with the one by Oersted. We report here the English translation of the relevant sentences (the full Italian text can be found in Fermi, 1935):

«Dear Sir,

only yesterday I received your note dated 30 August, with which you give me communication of the news published in Antologia, concerning my discoveries of 1802 on electromagnetism. I would ignore the criticism of prof. Gazzeri, if the paper of 1802 (which was explicitly written by Tamanini, who was present at the experiment) had been written by me . . . I would not have sent you the paper that you published at p.146 of the Antologia, if I had not found my duty to confirm an old oral communication given to Configliacchi and that he made public (in 1820). Such a public document is a guarantee even without asking the reason of the above criticism. In fact I was only an amateur physicist and I do not want the honour due to Oersted. Hence I do not see why I should have described the experience and the results. It was enough to discuss the fact by itself. Now I think that one cannot disagree with the statement of Antinori (who wrote to you last August) "since 1802 Romagnosi was interested in those investigations and obtained effects almost identical to the ones of Oersted". In such a way it is possible to guarantee my rights as you also pointed out. In fact the text of the Gazzetta di Trento had certainly circulated in Germany, so that, according to the rules of a correct criticism, one can conclude about the above discovery.

In any case I am very grateful to you for publishing the letter in the Antologia and for giving the proof that you were not responsible for that criticism . . . ».

With this letter, of which only the original draft is available, Romagnosi makes a rather clear claim of priority in the discovery of electromagnetism. It is in particular interesting to note that the words «effects almost identical to the ones of Oersted» are underlined in the manuscript (see fig. 4b). Romagnosi also says that the *Gazzetta di Trento* had certainly circulated in Germany. From this letter and from the comments by Fermi (1935) we also learn that the author of the text of the *Gazzetta di Trento* was

not Romagnosi, but Gian Michele Tamanini, an abbot from Vigolo Vattaro, a small village near Trento.

6. FINAL REMARKS

The documents discussed in this article provide additional information on the experiment carried out by Romagnosi in 1802 and on his relationships with the scientific community. The *Gazzetta di Rovereto* reports more details on the voltaic pile used by Romagnosi (size of the discs) and further emphasises the role played by the «Galvanic flow». The document of the Académie des Sciences proves that Romagnosi in 1802 sent his pamphlet to Paris to participate in the Galvani Prize. Finally, the letter written by Romagnosi to Libri in 1827 proves that he did actually follow the debate caused by Oersted's experiment and claimed priority in the discovery of electromagnetism.

Are these new elements enough significant to conclude that Romagnosi would deserve some credit for the discovery of electromagnetism? An answer to this question would require a deeper understanding of the Trento experiment whose description still remains obscure. In the Romagnosi papers there are important missing points which were understood and discussed by Oersted 18 years later:

- a clear description of the closed circuit allowing for the flow of the current;
- the understanding of the transverse nature of the force generated by the current;
- the fact that it is not necessary to touch the magnetic needle in order to observe the new effect.

One should however keep in mind that Romagnosi was working in a historical framework quite different from the one of Oersted. Volta had invented the pile only two years before and the general interest of physicists was mainly devoted to the search of effects of the current in other contexts (animal electricity etc.). Furthermore, though Romagnosi was in touch with Volta, Configliachi and other Italian scientists, he did not belong to the community of physicists and published his discovery in unknown journals.

In his book *Oersted and the Discovery of Electromagnetism*, Dibner concluded that the Romagnosi's experiment was carried out too early and that consequently could not have a significant impact on the scientific community: «Like the parable of the seed, the one (Romagnosi's experiment) was an early sowing that fall upon a stony place, the other (Oersted's experiment), made in the full spring and falling on rich soil, took root and flowered» (Dibner, 1962).

However it is not completely obvious that in 1802 times were not ready for such an experiment. The Volta's pile had become extremely popular, especially in Paris, where Volta presented it officially to Napoleon in 1801. Napoleon himself decided to establish a special prize (*Prix de Galvanisme*) for outstanding work on electricity and magnetism. If that was not enough to make a wonderful time for experiments, Ampere in Paris had asserted in 1802 that he would «demonstrate that the electrical and magnetic phenomena are due to two different fluids which act independently of each other» (Stauffer, 1953).

Indeed the time was exactly right for Romagnosi to rise to the challenge of the times and settle whether Ampere's fluids were connected or separate. Romagnosi accepted the challenge by devising a magnificently simple experiment which could be done in 1802 by a jurist in Trento. Unfortunately his attempt to draw the attention of the scientific community on his work, through the participation to the Galvani Prize, failed and the few scientists, like Volta, who were aware of the experiment, did not focus on the new message contained in Romagnosi's work. As Oersted (1830) himself pointed out «neither the French Institute, nor the learned societies, nor the numerous natural philosophers took any notice of this observation [Romagnosi's work], which would have accelerated the discovery of electromagnetism by sixteen years».

Old and new puzzles.

When we started investigating the history of the Romagnosi's experiment we were stimulated by some intriguing questions. One was the ambiguous distinction between the journals of Trento and Rovereto, which has remained unclear for almost 200 years. Another mystery concerned the «silence» of Romagnosi after 1802 that was systematically considered by many people an implicit and final proof of the irrelevance of his experiment. We have solved both these puzzles, but we have also found new unsolved questions that are left for future research:

- In the diary by Roberti (1877: p. 157) the date 24 April (or May?) 1802 is reported in connection with Romagnosi's experiment. This date does not appear in the *Gazzetta di Trento* nor in the *Gazzetta di Rovereto* which simply refer to the month of May. How did Roberti get it? Do other documents describing the experiment exist?
- According to Romagnosi, Gian Michele Tamanini wrote the text of the *Gazzetta di Trento*. Did he also play an important role in the experiment? Do other documents written by Tamanini exist?
- Very little is known about the relationships between Romagnosi and Volta before and immediately after the experiment of 1802.
- Do any further documents or reports relative to the Romagnosi's submittal to *the Prix de Galvanisme* exist? Who informed Aldini about Romagnosi's discovery?
- According to Romagnosi, the *Gazzetta di Trento* had circulated in Germany. However we have no proof of this important fact and we do not know who was aware of this text before 1820.
- Francesco Zantedeschi sent in 1845 a letter on Romagnosi's experiment to Oersted who however never replied. It would be useful to know more about this correspondence and in general to know when Oersted did become aware of Romagnosi's experiment.
- Is it possible, on the basis of the new documentation, to reconstruct the experimental setup employed by Romagnosi?

We expect that an answer to these questions will provide further light on Romagnosi's experiment and on the subsequent historical debate.

APPENDIX

Gazzetta di Trento (3 August, 1802)

«The Counsellor, Giandomenico de Romagnosi, of this city, known to the republic of letters by his learned productions, hastens to communicate to the physicists of Europe an experiment showing the action of the galvanic fluid on magnetism.

Having constructed a voltaic pile, of thin discs of copper and zinc, separated by flannel soaked in a solution of sal-ammoniac, he attached to one of the poles one end of a silver chain, the other end of which passed through a short glass tube, and terminated in a silver knob.

This being done, he took an ordinary compass-box, placed it on a glass stand, removed its glass cover and touched one end of the needle with the silver knob, which he took care to hold by its glass envelope. After a few seconds contact the needle was observed to take up a new position, where it remained even after the removal of the knob. A fresh application of the knob caused a still further deflection of the needle, which was always observed to remain in the position to which it was last deflected, as if its polarity were altogether destroyed.

In order to restore the polarity, Romagnosi took the compass box between his fingers and thumbs, and held it steadily for some seconds. The needle then returned to its original position, not all at once, but little by little, advancing like the minute or second hand of a clock.

This experience was made in the month of May, and repeated in the presence of a few spectators. In that occasion he also observed very easily the electrical attraction at a very sensitive distance. He used a thin thread soaked in a solution of sal-ammoniac, and it fastened it to a glass pipe, he then approached the silver chain to the thread at the distance of a "linea" and saw the thread flying and remaining attached to the knob as in typical electrical experiments.

Mr. Romagnosi believes it is his duty to publish this experiment that should become part of a treatise on Galvanism and Electricity in which he plans to discuss an atmospheric phenomenon that takes place every year near the Brenner and that strongly affects the local population which feels all the effects of Galvanism».

Gazzetta di Rovereto (13 August, 1802)

«The Counsellor, Giandomenico de Romagnosi, living in Trento, known to the republic of letters by his learned productions, hastens to communicate to the physicists of Europe an experiment showing the action of the galvanic fluid on magnetism.

Having constructed a voltaic pile, of thin discs of copper and zinc, separated by flannel soaked in a solution of sal-ammoniac, he attached to one of the poles one

end of a silver chain, the other end of which passed through a short glass tube, and terminated in a silver knob.

This being done, he took an ordinary compass-box, placed it on a glass stand, removed its glass cover and touched one end of the needle with the silver knob, which he took care to hold by its glass envelope. After a few seconds contact the needle was observed to take up a new position, where it remained even after the removal of the knob. A fresh application of the knob caused a still further deflection of the needle, which was always observed to remain in the position to which it was last deflected, as if its polarity were altogether destroyed.

In order to check this result he approached to the magnetic needle at the smallest possible distance (without touching it) either a watch spring or other iron objects, which before attracted the magnetic needle very strongly at a distance four times larger; but now, under the action of galvanism, had no effect at all.

To ensure success to the experiment, one needs the following precautions: not all the galvanic piles are good for the experiment, but only the ones whose discs have at least a thickness of a "linea" and are two inches of diameter; it is convenient to use an insulated pile, and not for a long time in order to avoid rapid oxidation at the surface of the discs; it is convenient to keep the chains suspended in such a way that they do not touch any body conducting electricity and to handle them with the glass tube; sometimes in order to ensure rapid success to the experiment it is convenient to touch the point of the needle with both knobs and then to make it deviate with one of them; and not forgetting before that to handle the chains with bare hands in order to excite the apparatus, since the galvanic flux has often some interruptions.

The needle used by Mr. Romagnosi was only one inch of length and one "linea" of width in the greatest extension near the pin. It was made of a watch spring well equilibrated and suspended on a steel pin.

In order to restore the polarity, Romagnosi took the compass box between his fingers and thumbs, and held it steadily for some seconds. The needle then returned to its original position, not all at once, but little by little, advancing like the minute or second hand of a clock.

He then put the needle under the action of Electricity, both vitreous and resinous, using a tube of rubbed glass or sealing-wax ("cera di Spagna"). The needle was strongly attracted and at some distance from the pipe, while with the knob it did not move. After removing the tubes the needle returned to the previous polar direction, while in the experiment with galvanism it remained in the same deflected position. The magnetic action of a piece of iron, which under the action of the galvanic fluid had no effect on the needle, was stronger than the opposite force of electricity that was simultaneously applied.

This experience was made in the month of May, and repeated in the presence of a few spectators. In that occasion he also observed very easily the electrical attraction at a very sensitive distance. He used a thin thread soaked in a solution of sal-ammoniac, and it fastened it to a glass pipe, he then approached the silver chain to the thread at the distance of a "linea" and saw the thread flying and remaining attached to the knob as in typical electrical experiments.

Mr. Romagnosi believes it is his duty to publish this experiment that should become part of a treatise on Galvanism and Electricity in which he plans to discuss an atmospheric phenomenon that takes place every year near the Brenner and that strongly affects the local population which feels all the effects of galvanism».

ACKNOWLEDGEMENTS

S.S. likes to thank Tim Procter for providing useful documentation from IEE (London) and Renato Mazzolini for pointing out the existence of the Romagnosi's letters to Libri. He also likes to thank Giuseppe Amoretti, Alberto Gigli Berzolari, David Brink, Luigi Radicati di Brozolo and Giorgio Salvini for stimulating encouragement during this work and John Heilbron for useful comments. The precious collaboration of Luisa Rossi Doria is also acknowledged.

The main part of this work was prepared in the winter 1996-1997. The final version was completed by one of us (SS) who takes the responsibility for any inaccuracy contained in the text.

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Pervenuta il 29 gennaio 1999,
in forma definitiva il 3 aprile 2000.

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Note added in proof. – Professor Robert Rathbun Wilson, co-author of this article, passed away sadly during the night of Sunday 16 January 2000. Robert Wilson's name will remain in the history of Science and Art for his many merits as a physicist, as a sculptor, as a writer. The force that characterised each of his activities and the level of his results made him an extraordinary individual. Here I recall primarily his activity as an experimental physicist and his interest also in Italian research. His scientific work covered various fields. We recall his nuclear experiments and his research on photons and electrons at Cornell University, the latter closely connected to our work in Frascati, which he inspired on various occasions. He is particularly famous for his work on large particle accelerators with electrons, protons and antiprotons. His fundamental contributions to the technology, projecting and building of these machines led to great improvements, with notable consequences on the performance and economy of the enterprise. In the personality of this extraordinary personage his many outstanding qualities converged: those of a physicist, an engineer and an artist, and certainly as a serious and intense sculptor. On many occasions our unforgettable friend Robert Wilson, a connoisseur of Italian science and art, achieved results of the highest level. This article that he co-authored with Sandro Stringari underlines another aspect of his personality: an attention and indefatigable curiosity for the history of Physics. Robert Wilson was born at Frontier, Wyoming (USA) on 4 March 1914 and concluded his splendid existence at 85 years of age (*Giorgio Salvini*).