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1. Introduction

Galileo Galilei was born in Florence in February four hundred years ago. When he died in 1642, the same year that Newton was born, a new era in the history of science had begun. This remarkable change in the history of science was largely due to the work of Galileo. It is not surprising that an upheaval of such magnitude could not occur without violent controversy. The life of Galileo was rather tumultuous, all the more so that Galileo himself was everything else but shy or retiring. He threw himself into the fray with relish and with gusto. He was not only a scientist who made a number of original discoveries of the greatest importance but he was also a polemic who used the spoken and written language with supreme mastery in the service of his ideas. His ideas were not always right and his tactics were not always fair and his enemies were not only frustrated Aristotelians and bigots. Among the notable collection of his opponents there were some who were seriously concerned with the consequences of his newfangled and strangely popular ideas.

It is then not altogether surprising that Galileo's fate came to a dramatic climax in his famous trial before the Holy Office.

On the morning of June 22, 1633, Galileo then a prisoner of the Roman Inquisition, was led to the great hall of the Dominican convent of Santa Maria Sopra Minerva. There, clad in a white shirt of penitence, he knelt before his judges and recanted solemnly the forbidden doctrine of Copernicus. The congregation of the Holy Office then sentenced Galileo to life imprisonment and the weekly recitation of 7 penitential psalms.

This was the culmination in the drama of Galileo's life-long struggle against an outworn scientific tradition. In 1616 his enemies succeeded in mobilizing the crushing machinery of the Holy Office against him. The Congregation declared the Copernican system as "philosophically erroneous and contrary to scripture" and that it could not be "held or defended as true". From then on his life became a nightmare of eggwalking until he was silenced forever by the verdict of 1633.

2. History of the records

Galileo's case is rather unique, because it is one of the few famous trials of the Inquisition for which an almost complete collection of records is available and published. (In the equally famous case of Giordano Bruno, for

instance, some records disappeared when they were in danger of becoming public). As such these records furnish a valuable case study of the workings of this famous tribunal. The proceedings of the Holy Office always have been a closely guarded secret and Galileo's case would still be shrouded in that secrecy, were it not for a peculiar circumstrance which brought these records to light. Early in the 19th century French troops occupied the city of Rome and Napoleon ordered a search made for these records in the archives of the Holy Office. They were found and brought to Paris in 1811, presumably with the intention of publishing them. This project never materialized, however, and in 1845 the entire collection was returned to the Vatican after a promise was extracted that they would be published in full. *)

A few years later in 1850 Monsignore Marino Marini, then secretary of the Vatican archives, published a book on Galileo's trial with quotations from the original trial records so selected as to substantiate the main thesis of the book, vz. that Galileo was tried and convicted for violating a secret injunction given to him in 1616 by Cardinal Bellarmine. According to this injunction Galileo was forbidden to discuss in any manner whatsoever the suspect Copernican theory.

Monsignore Marini's book started a flood of apologetic and polemic literature on the subject, much of which is worthless. In 1877 the French historian Henri de l'Espinois published all the records in the Vatican archives. Subsequent work by the German historians Emil Wohlwill and Kurt V. Gebler revealed beyond any doubt that the famous injunction was never given to Galileo and that a mysterious document which was found in the records in 1632 and published by Marini does not speak the truth. In spite of this, the original story of Marini has continued to circulate and is retold again and again in many popular accounts and encyclopedias.

Most of the records concerning Galileo and his trial are now very easily accessible for instance in the complete edition published by Favaro. However there remain several mysterious points and unless some missing documents can be found these points may remain forever in the shadow of doubt.

In this lecture I shall present first a rapid recital of the main events which culminated in the famous abjuration of 1633. In the second part I shall then give an analysis and interpretation of these events which will perhaps clarify some of the obscure aspects of this trial.

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*) A. Mercati, Atti della Pont. Accad. delle Scienze, Nuovo Lincei LXXX, Roma, 1927, p. 58-62.

3. Events preceding the trial

The events which relate to the trial of 1632 can be placed in three periods: 1609-1616, 1616-1632, and 1632-1642.

In 1609 we find Galileo at the age of 45 as professor of mathematics at the University of Padua. The news has come to his attention that a Dutchman has succeeded in constructing a telescope, and Galileo is able to reconstruct the instrument. In a very short time he makes a series of the most astounding discoveries. He notices for the first time the jagged mountainous structure of the moon's surface. He finds that planets appear as discs while the fixed stars have no measurable extension. Then he discovers the four moons of Jupiter, the structure of the Milky Way, the phases of Venus and Mercury, the ring of Saturn, the sun spots and the rotation of the sun. Any one of these discoveries would have made him immortal as an astronomer, and each was a blow to the old Aristotelian cosmology.

It would not have taken these observations to make Galileo a Copernican; he had been one for a long time, but, except for some private letters and some disputes, he had not yet written anything in which he presented his cosmological views to the world. In fact, he was now in his 45th year and he had published relatively little. His fame was based primarily on a work of his youth on the centre of gravity, and on his unique qualities as a teacher.

Galileo's astronomical discoveries in 1610 were the turning point in his life. He published a short book on these discoveries, the "Sidereal Messenger". He made efforts to obtain an appointment as court mathematician to the Duke of Tuscany in Florence, his home town, and succeeded in 1610. It was not only love of his home town, the immortal Florence, which prompted him to this step just after the Republic of Venice had offered him a promotion to a life-long professorship at Padua with a very good salary. He also wished to be relieved of a teaching duty which more and more had become a burden to him.

It was not long before Galileo felt that the change to Florence had some disadvantages. There was much less freedom here. In contrast to the Republic of Venice, the Jesuits had a very important influence in many affairs of the State, most of all in education.

He was soon involved in many scientific controversies with some powerful opponents. During the first years many of these controversies were more amusing than annoying, skirmishes rather than deadly serious battles.

But, his affairs took a serious turn in 1615. For some time certain opponents of Galileo, being unable to silence him with philosophical argumentation, had spread the rumour that the Copernican doctrine was contrary to the Holy Bible. Galileo followed only reluctantly into this field, but he had thought much about it and in a famous letter to his pupil and friend, Pater Castelli, professor of Mathematics in Pisa, he expressed his views on this point. He believed that a literal interpretation of certain scriptural passages should not be maintained contrary to scientific evidence. This became known to various people and now he had made himself vulnerable to a frontal attack from the theologians. In 1615 he was subject of a violent sermon by Pater Caccini who attacked him publicly and dubbed him a heretic. Shortly thereafter the first denunciation was turned in to the Holy Office in Rome.

According to the practice of the Holy Office at this time, an anonymous denunciation was sufficient to start preliminary investigations which were conducted with the utmost secrecy. When the invitation to the unsuspecting victim was issued to appear before the dreaded tribunal these preliminary investigations usually had already progressed very far. It must be said that they were under usual circumstances conducted with the greatest care and responsibility. Also, the fact that Cardinal Bellarmine, a man of stern but irreproachable character, was in charge of these proceedings should have been enough to guarantee the outcome. The fact was that Galileo had not transgressed any order of his Church. The Church or the Holy Office had never taken any stand on the question of the motion of the earth or the sun before 1616.

Galileo by an indiscretion heard that something was underway against him and so in order to clear himself of any suspicion of heresy and also in order to request a declaration from the Holy Office regarding the disputed Copernican doctrine, he went to Rome of his own free will. His trip to Rome was completely successful as far as the former point was concerned. The case against him was dropped for lack of any evidence. But it was not so successful with respect to the latter.

On February 26 Galileo met with Cardinal Bellarmine. During this meeting the Cardinal informed Galileo of the findings of the qualifiers regarding the thesis that the earth is moving and the sun is standing still. The qualifiers had found that these two theses were contrary to faith and the scripture and could not be upheld or defended as true. At the same time the Holy Office ordered several books on this subject, including the one by Copernicus, suspended until corrected. The corrections which were considered necessary give us a good indication as to how this decree must be interpreted. About two years later Copernicus' book was reissued with the corrections.

They could hardly be found. The book was allowed to stand in its entirety except for about half a dozen passages where a hypothetical language was substituted for the definite language of Copernicus. The attitude of the theological experts of the Holy Office coincides with that of Bellarmine himself, which he expressed privately in a letter to a friend of Galileo's a short time before the decree was issued. Since this letter describes exactly the sense of the decree, I quote it here. Bellarmine wrote as follows:

> "I think that you and Galileo would act more prudently if you presented your opinions as a hypothesis and not as an absolute truth. To assert that the earth is really moving is a very dangerous thing, because it would irritate the philosophers and theologians. To prove that the hypothesis of the immobility of the sun and the moving earth saves the appearances is not at all the same thing as to demonstrate the reality of the movement of the earth. I believe one can prove the first point, but I doubt strongly whether one can prove the second point, and in case of doubt one must not abandon the sense of the Holy Bible in which it has been interpreted by the Holy Fathers".

Bellarmine expresses in this letter a sharp distinction between <u>real</u> motion and <u>relative</u> motion (which "saves the appearances"), a distinction which at his time was perfectly natural and virtually accepted by all the learned world. This includes Galileo himself. In fact a great deal of fruitless effort was expended by Galileo to prove the "reality" of the motion of the earth and he erroneously believed that he had found such a proof in the phenomenon of the tides.

In the period from 1616-1632 which follows, Galileo often discussed the Copernican doctrine and related topics but always with the hypothetical proviso. Actually Galileo was not too much dissatisfied with this outcome, no doubt realizing that it could have been much worse.

In 1624 an important new event occurred which was destined to have a decisive influence on Galileo's position. Cardinal Maffeo Barberini was elected Pope Urban VIII. Galileo and Barberini had been acquainted with one an other for a long time. At the court of Tuscani Galileo often had opportunity to meet Barberini who had a keen scientific interest and who loved to participate in the learned disputes. He was basically sympathetic with the Copernican view, but he was cautious and did not wish to act too hastily. He expressed once to Galileo that, had it depended on him, the unhappy decree would not have been issued.

Pope Urban appointed as his private secretary Pater Ciampoli a former student of Galileo in Padua and a member of the Academy of the Lincei. This remarkable Academy under the leadership of the influencial Prince Cesi

had adopted as one of their main objectives the victory of the new Cosmology and the elimination of the Aristotelian dogmatism in the natural sciences. Galileo and his friends of the Academy were overjoyed at this favourable development.

In 1624 Galileo visited Rome again to pay his respects to the new Pope. He was received in several audiences by the Pope and was treated with the utmost courtesy and respect. His latest work, the "il Saggiatore", was a polemical reply to an attack by the Jesuit Pater Grassi. It was dedicated to the new Pope, who was greatly pleased with the work and had it read to him at the dinner table. Under such favourable circumstances there was great hope in the circles around Galileo of obtaining a revocation of the decree of 1616. But this proved to be impossible. The Pope did not wish to take any steps in this direction. Possibly he may not have considered the matter important enough to warrant any official action in this respect.

In spite of this setback, Galileo decided to go ahead with the writing of the main work of his life. He was now sixty years old and the wealth of evidence which he had accumulated for the Copernican cosmology was still not yet presented to the world. For him it was now or never. He could not afford to await a more favourable moment without endangering the whole work. Galileo never had the slightest intention of writing this work in defiance of the Pope and his advisers. Instead he was able to convince the Pope that it would actually be desirable to have an open discussion of all the reasons for or against Copernicus just (as he put it) to show that the decree of 1616 had not been issued without the full knowledge of all the scientific reasons for the Copernican system. This idea found the approval of Urban VIII and he even went so far as to give a theological argument for the Ptolomaic theory which he asked Galileo to include in the book.

Galileo set to work immediately and in four years, in 1630, the book was finished and ready to be printed. The work is no doubt a masterpiece of this kind of scientific writing. It breaks with a long tradition of scientific writing in latin by using the vernacular, which Galileo handled with a supreme mastery. Moreover it addresses itself not so much to the learned specialists who more often than not were the representatives of a sterile scientific tradition, but directly to the scientifically interested laymen. This short-circuiting of the scientific brass-hats was considered an affront to many of his academic colleagues but it was quite in the spirit of the time *). The book is written in a lively dialogue form.

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*) In a discussion remark Professor Bernardini pointed out that this popular appeal may have contributed a great deal to the fear and hostility with which the book was received by certain members of the Roman Curia.

The three interlocutors are: Simplicio, the Aristotelian, Salviati, his opponent, and Sagredo, an interested layman who acts as mediator. Every reason against Copernicus which had ever been brought forward is carefully discussed. He uses every device of argumentation. Sagredo, the amiable mediator, is full of wit and humor and always ready with a little anecdote to illustrate a point which hits the nail on the head, driving home an argument. Galileo is very careful to make sure that the hypothetical form is maintained, but in spite of this handicap he presents his reasons for the Copernican cosmology so convincingly that nobody has any doubt as to the true intentions of the author.

In 1630 Galileo brought the work to Rome and submitted it to the Roman censor, the amiable Pater Riccardi. He was well disposed towards Galileo, but weak and frightened. He was a cousin of the wife of Niccolini, the ambassador of the Duke of Tuscani. The Niccolini's were both cordial friends of Galileo and they used their respective influences to the utmost to obtain a quick and favourable decision from Pater Riccardi. Niccolini stood on very good terms with the Papal court and he had considerable political influence. His wife had an irresistible charm to which nobody could remain insensitive and both knew how to appease Pater Riccardi's insatiable appetite for good food and wine. He was jocularly known in Rome as "Father Monster" not because of his ferocity, but because of his immense weight.

There was nothing to fear from him. Besides he was a poet, not a scientist. He was incapable of realizing the full import of the scientific content of this work but intelligent enough to understand the possible conflicts which may arise therefrom. For judging its content he had to rely entirely on other, more competent, collaborators who however informed him that there was nothing objectionable in the book. Riccardi was reluctant and tried to stall. He suggested several minor changes to which Galileo readily agreed, and he proposed a foreword and conclusion which were also accepted. The most significant change was that of the title of the book. Galileo had intended to call it "dialogue on the causes of the tide". With this title he intended to give prominence to the argument for the movement of the earth deduced from the tides which he thought was the most convincing of them all. By a curious irony of fate Galileo, who was so often right in scientific questions, erred in this point. The Pope believed, with many other contemporary scientists of his time, that the tides were caused by the attraction of the moon and that they had nothing to do with the motion of the earth. As we know now he came closer to the correct explanation than Galileo. The Pope then suggested to Riccardi a change of the title which was, of course, also accepted *). The new title was "dialogue on the two major systems of the world."

*) It is not quite certain whether this proposed title change originated with the Pope himself or with the papal secretary Ciampoli. For several reasons I am inclined to the latter version although Riccardi seemed to give the impression that the suggestion originated with the Pope himself.

The printing of the book was actually delayed for almost two years, partly caused by the Pest which forced Galileo to return to Florence before the transaction with the censor was finished and partly by the stalling of Riccardi. In the meantime Galileo had received the Imprimatur of the Florentine censor. Finally the Roman Imprimatur was also given and the book was at last published with the official assent of two experts and two censors. This was 1632.

The events which followed the publication of this work happened with surprising rapidity. The book was an immediate success. It was received with enthousiasm by the new school of scientists in Italy and abroad, and with anger and abuse by the Aristotelians. In September 1632 the book was suspended by the Holy Office and Galileo received a summons to appear before the Inquisition in Rome. Galileo was at that time in very poor health and he pleaded whether he could not be questioned in Florence in order to spare him the difficult trip to Rome. The reply to this request sounded ominous. He was threatened that he would be brought to Rome in chains if he did not obey as soon as his health permitted the trip.

Galileo finally arrived in Rome on February 13, 1633 and the trial took place between April and June of this year, ending with the famous condemnation and humiliating abjuration *). He was sentenced by his judges to life imprisonment, later changed to house arrest in his villa at Arcetri near Florence by Urban VIII. There Galileo spent the last nine years of his life in growing isolation but still active to the end of his days.

We have now made a quick survey of the last 30 years of Galileo's life, culminating in the famous trial of 1633.

In the next part of this lecture, I would like to focus your attention a little more sharply on the trial itself.

4. Analysis of the trial

If one studies the records of the trial attentively, after a while, one gets the impression that this trial is not what it purports to be, a trial concerning the Copernican system, but that there are other, hidden and more sinister motives at work.

The first indication that something is amiss comes to light if we ask what were the legal foundations of this trial ? It is well to remember that the Inquisition was an institution which adhered to legal processes to a degree which is surprising in view of the fact that its transactions were conducted under a cloak of complete secrecy and that it had complete power over every individual under its jurisdiction.

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*) It is virtually certain that Galileo was not tortued in the technical legal sense of the term. However during the last examination he was threatened with torture.

We have just seen that Galileo's dialogue was written with the consent of the Pope and published with the explicit permission of two censors of the Church. How then could he be brought before a court? On what counts was he tried, found guilty and sentenced?

What happened to transform the generous friend of Galileo, Urban VIII, in such a short time into an angry enemy, who never wished to see him or speak to him again?

The quickest way to get at the clue of this puzzling problem is to read the records of the trial which took place in 1633. In this trial the evidence which was used by the prosecutor against Galileo was a certain protocol of the meeting of February 26, 1616, according to which Galileo had been given a secret order not to discuss the Copernican doctrine in any way whatsoever. This meant a special order which would apply only to Galileo. His guilt then was to have violated this special order and to have obtained the Imprimatur of the censor without mentioning this special injunction for him.

It is the great merit of Emil Wohlwill to have collected convincing evidence to show that this order never existed, that the famous protocol does not speak the truth, and that it was used in bad faith for the purpose of annihilating Galileo.

The first mention of this famous document was in a letter addressed to Galileo by Niccolini, the Tuscan ambassador. Riccardi, in September 1632 during a visit at Niccolini's house, had entrusted to them, under the cloak of the greatest secrecy, the news that a document had been found in the Archives of the Holy Office which alone would suffice to ruin him.

The existence of such a secret injunction was a surprise to everyone, most of all to Galileo himself.

Cardinal Bellarmine, who surely would remember an order of this sort and whose testimony would be decisive, was no longer alive. There were several other witnesses mentioned in this protocol but none of them appeared at the trial.

What did actually take place during the meeting of February 26, 1616? The best sources of information are the persons immediately connected with it: Cardinal Bellarmine and Galileo.

Fortunately there are two very important documents available which tell us what did take place. The first of these is a letter from the Cardinal to Galileo shortly after the meeting of February 26, which was written at the request of Galileo. After this meeting evil tongues spread the news that Galileo had to abjure and was given a penance by the Cardinal, and in order to protect himself against such slanders Galileo asked the Cardinal to give him a statement of what actually happened. This the Cardinal did.

(Rome, May 26, 1616)

"We, Robert Cardinal Ballarmine,since we have heard that Mr. Galileo Galilei has been calumniated and accused of making an abjuration, with the result of penances being laid upon him, and since we have been approached for a testimony of the truth, do declare that the aforementioned Galileo has not abjured, neither to us nor to anyone else in Rome, nor, so far as we know, any other place, any of his opinions or teachings, so that also no penances have been laid upon him, but only that declaration, given by Our Holy Father and published by the Holy Congregation of the Index, has been brought to his knowledge, the contents of which are that the doctrine attributed to Copernicus, that the earth moves around the sun and that the sun stands in the centre of the world without moving from rising to setting, is against the Holy Scriptures and that therefore it is not possible to defend it or hold it, as witness to which we have written and signed this present (document) with our own hand.

May 26, 1616

As above, Robert Cardinal Ballarmine"

Galileo presented this letter as evidence for his defense and it was accepted, but no attention was paid to its content. The implication apparently was that the Cardinal had not stated everything for reasons perhaps to protect Galileo or the secrecy of the order.

Fortunately there exists another document. A few days later, namely on March 3, 1616 there occurred a meeting of the Holy Office with the Pope, Paul V. And we have the minutes of this meeting. Here there would surely be no occasion to withhold anything for reasons of secrecy or prudence. This was the inner circle, everything of importance would be brought to light, and what would be more important than a special secret injunction of this nature? We find nothing of this sort. This is how the minutes read:

"On the 3rd of March, 1616. From the most illustrious Mgr. Cardinal Bellarmine was at first reported that the Mathematician Galileo Galilei had been admonished to give up the hitherto held opinion that the sun is the centre of the heavenly sphere and immovable and the earth, on the other hand, movable, and that he had acquiesed; then was the decree of the Congregation of the Index announced, in so far as the writings of Nicholas Copernicus ("On the Motions of Heavenly Bodies"), of Diego of Stunica on Job, and of the Carmelite monk, Brother Paulus Antonius Foscarini had been forbidden or suspended; His Holiness ordered herewith the publication of this edict of prohibition or suspension to be carried out by the palace master."

This document was not contained in the first complete publication of the trial records. It was discovered only in 1870.

It should have been available to the Judges who tried Galileo since it was the official minutes of the meeting of the Holy Office with Pope Paul V. However, it is most remarkable that just this official document which was in contradiction with the dubious but incriminating one was not used at the trial. Nor was it mentioned by the official revelation of the trial by Mrg. Marini in 1850.

Let us hear now Galileo himself. A short time after the meeting with Bellarmine he writes a letter to the Duke in which he accounts in great detail the latest events in his affair, among others also the meeting with Bellarmine. His description coincides exactly with that of Ballarmine, there is no mention of any secret order whatsoever.

In none of the numerous other letters of Galileo do we find any indication of such a special order. In fact, we find instead his wish to accelerate the corrections of Copernicus' book so that he would know exactly in what sense one could write about this system of the world.

Finally, we find Galileo before the tribunal in 1633 denying at first ever to have received a special order of this sort. This is most telling because Galileo knew perfectly well that there would be no point in denying a fact, since the facts surely would all be available to his judges. Instead we find him most eager to say anything his questioners want him to say. But on reading the records of the first meeting one finds that at first Galileo does not even know what they want him to say. He is now really afraid. He knows that this time they are out to get him. He knows of no order, but admits he could have forgotten it. The most significant point is that Galileo never admits having received this supposed "order" from anybody else but from Cardinal Bellarmine himself. This is in flat contradiction with the questionable protocol on which it is noted that the secret order was given to Galileo by the Commissioner of the Holy Office. Galileo has not the faintest recollection of any of this. It is clear that he remembers only as much as is contained in Bellarmine's letter. Would there have been any point in lying, since the Inquisitors have all the information in their hands? It is only gradually that they succeed in suggesting to him the right answers which he willingly supplies, although he says repeatedly that he cannot remember any special order.

During all this time between 1616 and 1632 Galileo discussed questions related to Copernicus and his theory freely and without hesitation, although always with the proviso that he considered it only a hypothesis and not an established fact, as it was required of him to do. Thus during all these years he would have violated at every turn the supposed order and no one had made any move to stop him. He even discussed with the Pope and several

Cardinals the theory of Copernicus and he received the Imprimatur to print all his books, including the fatal one on the two systems of the world. A consistent violation of such an order would have been in complete disagreement with Galileo's character. He was never known to wilfully and deliberately disobey any of his superiors.

Evidently the key to the solution of this riddle must be the document mentioned for the first time by Riccardi in a discussion with Niccolini. Let us therefore look at this document a little more carefully.

We observe that this document carries no signatures. We know from many instances that under normal conditions an anonymous document could never be admitted as evidence in such a serious crime. The Inquisition courts were most particular in such details, and as a matter of fact is was not used as such in Galileo's trail. It is very probable, however, that the judges had the document before them when they questioned Galileo.

Because of this lack of admissable evidence the judges were in a difficult situation. The next best thing they could do was to try to extract an admission from Galileo that he had received such a secret injunction as it is mentioned in the document. It would have been easy then to prove that he had violated it. But Galileo did not make such an admission. All he admitted was, that it could have been possible that such an order had been given to him, but if it was he had surely forgotten it by now.

This left the case against him incomplete. An indication of the embarrassement of the judges can be found in the following fact.

The trials of the Inquisition had a regular procedure which was prescribed to the minutest detail and which was always followed. This procedure called for the opinions of the theological and legal experts at the end of the testimony. Galileo's trial was no exception to this rule. In the records we find, indeed, the lengthy statement from the two theological experts at its proper place after the last testimony. But if we look for the legal experts' opinion we are bound for a disappointment. They are missing from the records and in the place where they would be expected to occur are instead a few empty sheets of paper. Were they once there and perhaps removed at a later time? We cannot say today.

One could perhaps expect a departure from the procedure if the legal aspects of the case were so clear that no expert could contribute any clarification to the legal question. However in the case of Galileo the legal aspect was much more delicate than the theological one. It is very likely that such an expertise did once exist but that its content would have made Galileo's condamnation virtually impossible.

Today we can only marvel at the coincidence that precisely that part of the record is nonexistent which would contain the most significant information.

About 1870 another interesting point was noticed by the historians. The verdict is preceded by the names of ten Cardinals who were the judges in this trial, but the document carries the signature of only seven of them. Three are missing. This point was covered up for more than two hundred years because the verdict was published "by mistake" with the names of all the ten Cardinals. This gave to the world the impression of unanimity, whereas actually there was a dissenting minority.

There is substantial evidence available which shows that the judges were not entirely free but that they were under a strong pressure from the Pope to come up with a verdict of guilty.

At the beginning of the trial two of Galileo's influential friends who might have been called as witnesses on his behalf were secretly removed from Rome. From the existing records we can see that Pope Urban VIII had himself prearranged the trial, the judgment and the sentence, including its subsequent commutation. The judge advocate whom he appointed was the Jesuit Melchior Inchofer, one of Galileo's most outspoken enemies, and an all too willing tool of the Pope.

Officially, however, the Pope assured the ambassador Niccolini that the trial was in the hands of the Holy Office, but that he would do everything in his power to alleviate the sentence. Thus he played a double role. He had almost complete control of the body which judged Galileo, but before the world the power and responsibility rested with this body. The judgment and the sentence came out exactly as prearranged by the Pope. Whatever opposition there may have been to this kind of justice must have been silenced in a stormy meeting of the ten Cardinals who judged the case. Unfortunately, not a trace of a record is left of this meeting. The only outward evidence of the dissension are the missing signatures of the three dissenters.

I come now to the most difficult part of the interpretation. We have seen so far that the annihilation of Galileo was primarily the work of the Pope himself. Although he pretended in his audience with Niccolini to have no power over the decision of the tribunal, the existing records speak quite a different story. It is quite evident that the power was his and his alone.

But this fact presents us only with a new puzzle which so far no one has been able to resolve satisfactorily. Galileo was led to believe for several years that his work was undertaken with the consent of the Pope. And when the work was finished it was passed by the highest censor of the church. This whole situation looks almost like a trap, like a "frame". But what could be the reason for such a monstrous deed? Surely it would have to be a very serious and weighty reason indeed. Unless one can find the motive it is very difficult to believe this interpretation.

However one looks at this attitude of Pope Urban VIII it does not seem to make any sense. Again and again one has explained this "volte face" as an expression of the concern and anger of the Pope over Galileo's reckless insult to the Church. But this does not make any sense either, because already as Cardinal Barberini the Pope had been a liberal in the interpretation of the decree of 1616. Already then he had regretted the"unfortunate" decree of the Holy Office. Pope Urban has never, before or afterwards, shown any concern over the Copernican cosmology as a danger to the faith except in the case of Galileo. In fact his whole attitude before and after seemed to indicate that he considered this rather a minor issue.

The most telling indication of his relative neutrality in this issue is his relation to Campanella. At that time Campanella, the philosopher and poet, was one of the most outspoken defenders of the Copernican system in Italy. In 1627, Campanella was a prisoner of the Spanish Inquisition in Naples. But his crime had nothing to do with the Copernican controversy. He was held by the Spanish for political reasons. The Pope demanded his extradition to Rome, which was granted. He then immediately ordered his release, granted him a permanent pension and later in 1634 helped him to escape to Paris from the dangers of Spanish persecution in Rome. From this case we can see that political considerations were much more important to the Pope than philosophical ones.

An explanation of the Popes sudden change of temper has been given as follows: As we have mentioned, before 1632 the Pope discussed cosmological problems with Galileo on many occasions. One of his most favoured arguments against Copernicus was a theological one which he asked Galileo to include in the book. The argument goes essentially as follows: Since God is omnipotent he is not bound by natural laws. Thus even if the heavenly phenomena could only be explained in terms of the Copernican system, this would not mean that the sun really stood still and the earth moved, since God in his almighty power could easily arrange the phenomena in such a particular way, without being thereby bound to adhere to the conclusions.

Galileo did take this argument up in his book and gave it a very prominent place indeed, namely at the end of the book. After Simplicio is beaten on all counts, with nothing more left to say he begins the argument of the Pope with the words: "Anyway it has been told to me by a very eminent person in high office...". Salviati in mock admiration lauds this as a most angelic argument. After what went on before, this was so obviously satirical that Galileo came under suspicion that he was ridiculing the Pope.

Already as Cardinal Barberini had the reputation of being one of the most learned Cardinals in Rome. He was well versed in many sciences and he was very proud of his erudition. He missed no opportunity to draw the greatest scientists, artists, poets and philosophers into his presence and

DIALOGO
DI
GALILEO GALILEI LINCEO
MATEMATICO SOPRAORDINARIO
DELLO STVDIO DI PISA.
E Filoſofo, e Matematico primario del
SERENISSIMO
GR. DVCA DI TOSCANA.

Doue ne i congreſſi di quattro giornate ſi diſcorre ſopra i due

MASSIMI SISTEMI DEL MONDO
TOLEMAICO, E COPERNICANO;

Proponendo indeterminatamente le ragioni Filoſofiche, e Naturali tanto per l'vna, quanto per l'altra parte.

CON PRI VILEGI.

IN FIORENZA, Per Gio: Batiſta Landini MDCXXXII.

CON LICENZA DE' SVPERIORI.

Title page of the Dialogue

Imprimatur ſi videbitur Reuerendiſs. P. Magiſto Sacri Palatij Apoſtolici.
A. Epiſcopus Bellicaſtenſis Vicesgerens.

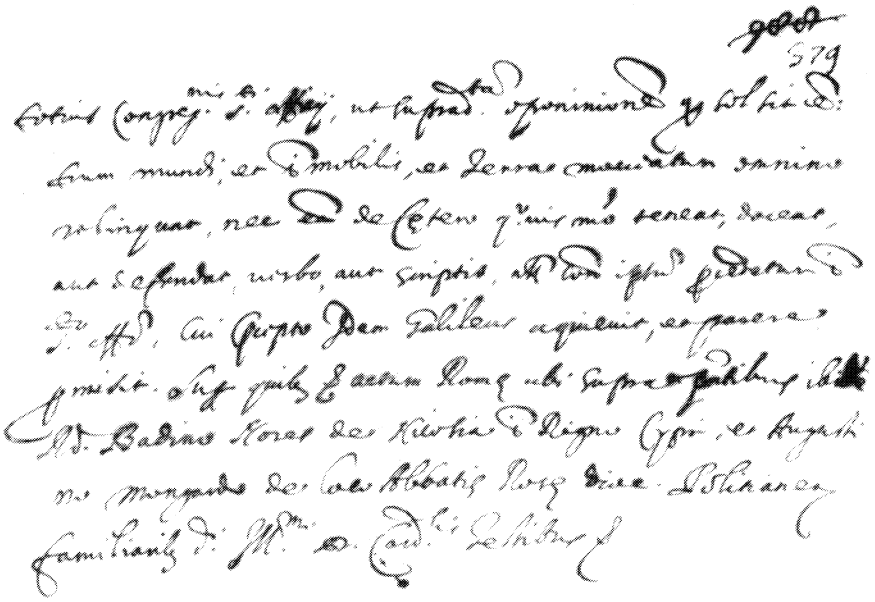
Imprimatur
Fr. Nicolaus Riccardius
Sacri Palatij Apoſtolici Magiſter.

Imprimatur Florentiæ ordinibus conſuetis ſeruatis.
11. Septembris 1630.
Petrus Nicolinus Vic. Gener. Florentiæ.

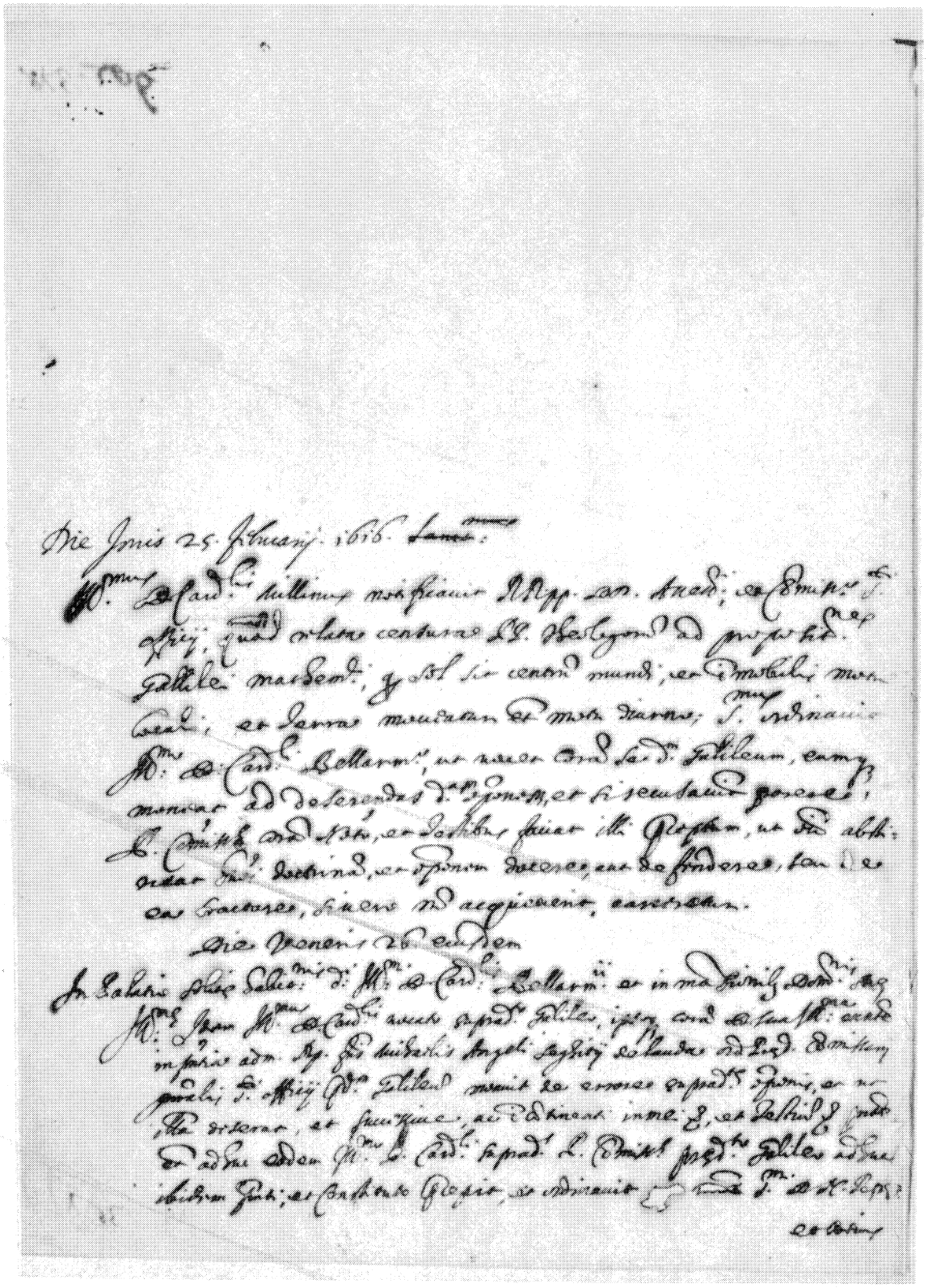
Imprimatur die 11. Septembris 1630.
Fr. Clemens Egidius Inqu. Gener. Florentiæ.

Stampiſi adi 12. di Settembre 1630.
Niccolò dell'Altella.

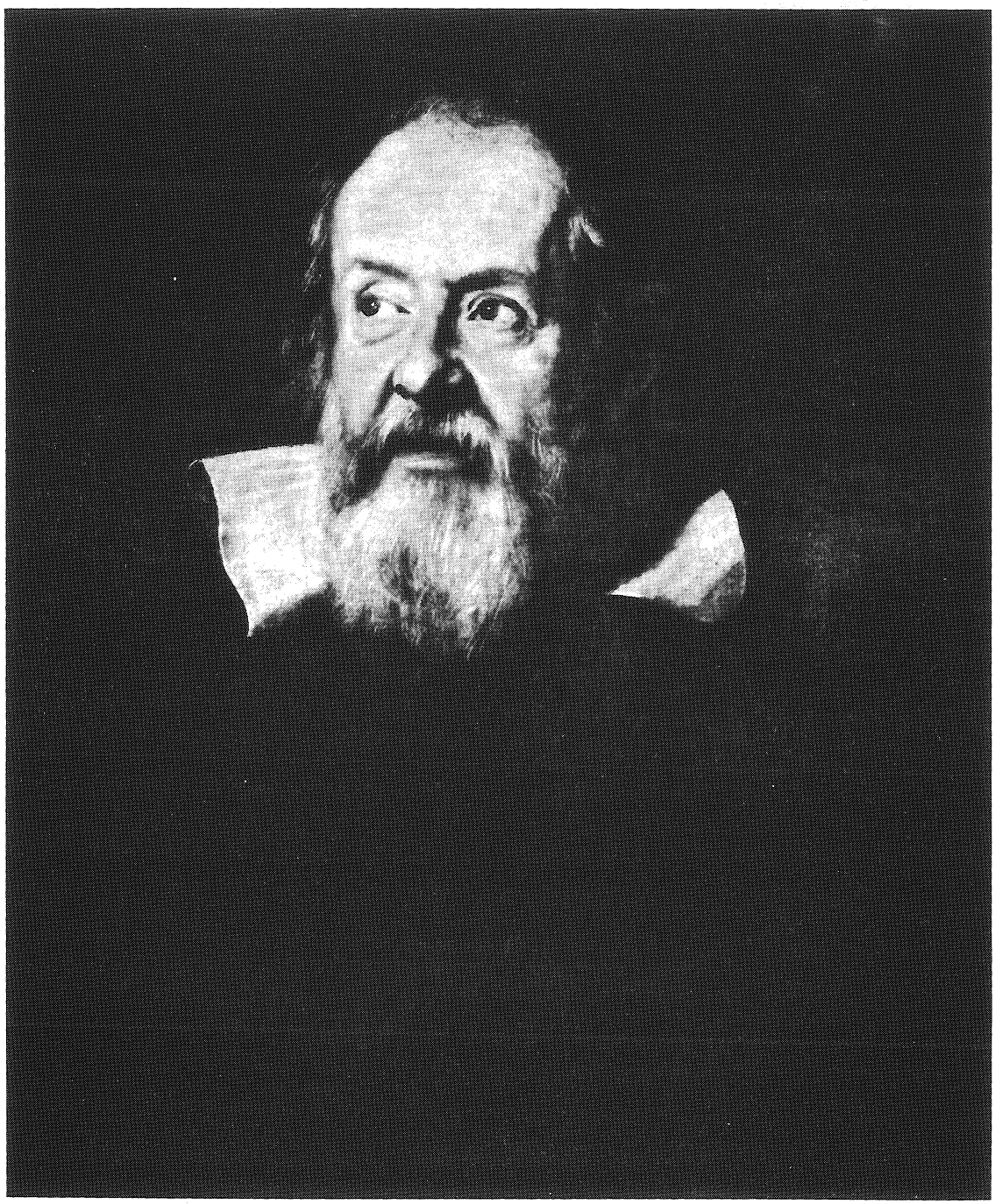
The imprimaturs of the first edition (1632) of the Dialogue



the false information concerning the secret order.



Facsimile reproduction of a document from the "Processo di G. Galilei", Misc. Arm. X, 204, ff. 43^{v} - 44^{r} (formerly ff. 378^{v} - 379^{r}, quoted by Favaro). This document contains



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Galileo Galilei

Portrait by Justus Sustermans

to dispute with them. We know from contemporary sources that these "discussions" often degenerated into a sort of a monologue with an occasional admiring remark interspersed by the visitor. Urban VIII was certainly very proud, selfsatisfied and vainglorious. On many occasions he had demonstrated that he could be very dangerous when his ego was insulted.

All the learned world knew that this argument was the Pope's own special contribution to the famous controversy and now Galileo presented it in such a manner that he seemed to appear ridiculous. Could it be that such personal considerations crept into his relations to Galileo? Could he have used his power as Pope for the purpose of personal revenge? We do not know the answer, for certain historical documentary proofs do not exist but psychologically the explanation fits the general character of Urban VIII very well*).

*) The true character of Pope Urban VIII is very difficult to ascertain today from contemporary sources. It was extremely dangerous to state anything in public which could have been interpreted as detrimental to the reputation of the Pope. Several persons died and others were severely punished for permitting themselves liberties in this direction.

One of the most valuable sources of information concerning the character of Pope Urban VIII can be found in the reports of the Venetian ambassadors to the court of Rome preserved in the Venetian Archives. For instance the ambassador Zuanne Nanni on returning from his embassy in Rome writes on July, 1641 about Urban VIII as follows:

"He possesses great talents and great qualities, has a wonderful memory with courage and energy that sometimes render him too firmly fixed to his own ideas. He has extensive powers of intellect, increased by experience of government and the world. He thinks very highly of his own opinion, and therefore does not love taking counsel, nor does he much regard the qualities of his ministers, who might nevertheless give increased force to his measures".

A similar tone is struck by Aluise Contarini who was the Venetian ambassador in Rome from 1632 till 1635.

"In every position the Pope always held a high opinion of himself, desiring to rule over others, and showing contempt for the opinion of all. He seems now to proceed more liberally, since he finds himself in a position eminent above all others. He has great talent but not sound judgement. Talent, for in things that depend on him alone, and which concern his person and house, he has always attained the objects he has proposed to accomplish, without shrinking from those intrigues and artifices which are, indeed, entirely congenial to his nature, as was seen in his canvassing for the papacy, during which he found means to reconcile in his own favour the two opposite factions of Borghese and Ludovisio merely by making each believe him the enemy of the other."

The relation of Galileo with the Jesuits was of the greatest importance in this affair. The Jesuits themselves have never denied it and in fact were quite open about it. For instance Pater Grienberger, who was a Jesuit himself and at the same time a personal friend of Galileo, wrote much later to a common friend about this trial as follows:

> "If Galileo had known how to keep himself in favour with this order, he would now appear famous before the world, he would have been spared all his misfortune and could have written freely about everything, including the motion of the earth".

In 1635 friends tried to get the sentence suspended, but they were without success.

Galileo in one of his last letters wrote about this to a friend:

> "... I do not expect a commutation of the sentence because I have not committed any crime. I could expect forgiveness and pardon if I had done so, because it is such offences which would give a sovereign the opportunity to show his generosity and forgiveness, while a man who is sentenced innocently must be treated without any pardon to prove that one is in the right."

When Galileo wrote these words he was close to his death. He had long made peace with his God. There is no doubt about the sincerity of his personal religious faith and for me this utterance of the dying old man is the most convincing proof of his innocence.

5. The aftermath

It is hard to underestimate the importance of this trial for the history of western civilization. The verdict, with its incomplete information on Galileo's guilt was published and it was read in parish churches all over the world. It created a conflict in the minds of many thinking believers and it had a stifling influence on science, especially in Italy. It is probably the chief reason why the centre of gravity of scientific activity moved north-west and why Italy lost much of the initiative which it had in the 15th and 16th century. The brilliant group of avantguard scientists the Academy Lincei collapsed ignomiously. One of the last pupils of Galilei, Viviani wrote a biography which he dared not publish until his death. In this biography the unfortunate events which had happened in Rome 1632-33 were discussed only very gingerly. Viviani compensates his sense of frustration regarding these events by embellishments of Galileo's life story which were at the origin of many of the legends which have grown up around this story.

Most important of all, Galileo's encounter with the Holy Office has contributed to a most unfortunate feeling of a basic and irrefutable cleavage between faith and reason which has persisted to this day. It took two hundred years before Galileo's writings were removed from the index and his body could be given a decent burial place in the church of Santa Croce in Florence. How much longer will it take before the illegality of the verdict will be officially acknowledged?
