

Articoli/11:

Jesuit Scientific Tradition and Ignatian Spirituality

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Abstract: From its foundation by St. Ignatius in 1540 and linked to its educational work, the Society of Jesus has maintained a continuous and institutional involvement in the natural sciences unparalleled by any other religious order in the Catholic Church. Because its foundation coincided with the beginning of modern science and the educational work in colleges and universities, mathematical and experimental science was soon introduced in their programs. Thus the Jesuit scientific tradition was established. This tradition can be explained by the characteristics of Jesuit or Ignatian spirituality, a mystique of service, understood as a service to God through the apostolic ministry to men. At its core is the emphasis of “finding God in all things” and seeking in their work the greater glory of God. This leads Jesuits sometimes to unconventional work on the frontiers an example of which is scientific work. Jesuit scientists found an affinity between scientific work and their spirituality and try to integrate both together in their lives.

1. Jesuits scientific tradition

A few years after its founding in 1540 by Saint Ignatius of Loyola and his first companions, the Society of Jesus began its educational endeavor as the key instrument of its apostolic work. By the 18th century Jesuits ran about 600 schools in Europe, India and Central and South America. Mathematics and astronomy were introduced very early in their educational programs. Thus, Jesuits became involved in the sciences in a way no other religious order has been, their scientific work has been the subject of many studies¹. Christopher Clavius (1537-1612), professor of mathematics in the Collegio Romano, the Jesuit school in Rome and a model for all other Jesuit schools, can be considered as the founder of the Jesuit scientific tradition. He insisted on the importance of mathematics for the proper understanding of natural philosophy and its central role in teaching in Jesuit schools. The first period of Jesuit work in science runs from 1567, when Clavius began

¹ Among the recent books dedicated to this subject: Luce Girard, (ed.), *Les jésuites à la Renaissance. Système éducatif et production du savoir*, Paris 1995; Antonella Romano, *La contra-réforme mathématique. Constitution du savoir*, Paris 1999; Mordechai Feingold (ed.), *The New Science and Jesuit Science: Seventeenth Century Perspectives*. Dordrecht 2003; Mordechai Feingold (ed.), *Jesuit Science and the Republic of Letters*. London 2003; Agustín Udías, *Searching the Heavens and the Earth: The history of Jesuit observatories*, Dordrecht 2003; Marcus Hellyer, *Catholic Physics. Jesuit Natural Philosophy in Early Modern Germany*, Notre Dame, Indiana 2005.

as professor of mathematics, to 1773 with the suppression of the order. A few names to illustrate this period are in mathematics, Gregoire de Saint-Vicent (1584-1667) founder of school of higher mathematics in Antwerp, Claude F. M. de Chales (1621-1678) professor in Lyon and Giovanni Sacheri (1667-1733), professor in Milán and pioneer of non-Euclidian geometries; in astronomy Christoph Scheiner (1575-1650), professor in Ingolstadt who can be considered the founder of heliophysics, and Giovanni B. Riccioli (1598-1671), professor in Parma, author of a comprehensive textbook on astronomy.

During this time Jesuits established 26 astronomical observatories in their schools. At that time they were almost one fourth of all existing observatories. Two key figures of this period are Athanasius Kircher (1602-1680), polymath and among the founders of geology and Roger Boscovich (1711-1787) a pioneer in modern atomic theory. An important chapter of this period is the saga of Jesuit astronomers in China where, since the arrival of Mateo Ricci (1552-1610) to Beijing, they introduced European astronomy and were for 150 years the directors of the Imperial Observatory. Less known is the work of Jesuit astronomers in India and Indochina. The discovery of America provided the Jesuits with the possibility to study the land, fauna and flora of the new world and to explore unknown territories from Canada to Patagonia. From their interest in geography Jesuits drew the first maps of many regions of America, China, India, Tibet and Ethiopia. When Jesuit scientific work was at its peak it was interrupted by their suppression in 1773.

A new chapter of Jesuit scientific work began with the restoration of the order in 1814. From 1825 Jesuits founded a new network of about 70 astronomical, meteorological and seismological observatories throughout the world. Those installed in Africa, Asia and Central and South America were in many instances the first scientific institutions in these countries. In this period Jesuits made important contributions, especially to the study and forecast of tropical hurricanes and to research in seismology and terrestrial magnetism. Among the relevant figures of this period we can mention Angelo Secchi (1818-1878), director of the Roman College Observatory and a pioneer of astrophysics; Stephen Perry (1833-1889), director of the Stonyhurst Observatory (Great Britain), an early researcher in geomagnetism and solar physics; James Macelwane (1883-1956), professor of Geophysics at Saint Louis University (United States) and director of the Jesuit Seismological Association, and Pierre Teilhard de Chardin (1881-1955) a paleontologist who worked on the early human fossils in China and became famous for his ideas about evolution and the future of mankind. At present Jesuits run 133 universities and about 200 secondary schools around the world. A number of Jesuit professors of science combines today teaching and research keeping alive the scientific tradition of the Society of Jesus.

2. Science and Jesuit spirituality

We come now to the question of how this especial presence of Jesuits in science can be explained. There is no doubt that other religious orders have also had important scientific figures, for example, Gregor Mendel,

pioneer of genetics of the Augustinian Order. With Jesuits, however, we find a continuous and institutional presence since the very early days of their foundation to the present. It is indicative of this especial presence in science that eighteen years after the establishment of the Vatican Observatory, Pope Pius X entrusted the Jesuits with its direction which they keep up today. This dedication to science was present during the first period of the history of the Society of Jesus until its suppression in 1773 and was continued after its restoration in 1814 until our times, as we have seen in the short summary above. It is, then, pertinent to ask what is especial about the Jesuits which explains this continuous dedication to science.

Steven J. Harris wrote one of the first studies which tries to find an answer to this question². He based it only on the Jesuits of the 17th and 18th centuries, but his ideas can be also applied to modern Jesuits. In a very detailed and well founded analysis, Harris puts the basis of Jesuit dedication to science on what he calls the “apostolic spirituality”, which is at the core of “Jesuit ideology”. The term “Jesuit ideology” was first used by Rivka Feldhay to denote their way of viewing knowledge as a path to salvation³. For Harris the main elements of this spirituality are the following. In first place, the emphasis placed on Christian service which channeled religious sentiments outward and into worldly activities not usually associated with religious life. To this he adds an active engagement with the world which leads to a respect for experience or a “testing against experience” and “proof by trial” which became standards of evaluation of ideas and projects. On the scientific field importance was given to experimental aspects of observations and experiments. Thus, for Harris, the apostolic spirituality which constitutes the basic force which shapes the character of the activity of every Jesuit, includes the motivation for scientific work. Another element is an especial “esteem for learning”. This leads to what he calls the “sanctification of learning”, which is responsible for the enormous effort of Jesuits since their origin in the field of education with the foundation of colleges and universities. According to Harris the sanctification of learning drove them to commitments with secular activities put to the service of ultimately spiritual goals, that is, the salvation of the souls. He sees this work being carried out in three main areas: in education, in European courts and in the foreign missions.

Historical factors, also mentioned by Harris, played an important role. In first place is the coincidence of the foundation of the Society of Jesus with the beginning of modern science and its dedication to education in schools and universities. Jesuits when they established their schools didn't have a doctrinal tradition which conditioned them, as was the case, for example, of Dominicans and Franciscans. Jesuits could incorporate their teaching more easily to the new currents of modern science and thus answer to the social demands of those times. In this way, Jesuits could incorporate in their teaching the new currents of mathematical and experimental sciences. Clavius, with his influential position, made a great effort to introduce teaching of mathematical sciences in Jesuit colleges which was finally accepted in the norms established for all schools by the Ratio Studiorum.

² Steven J. Harris, *Transposing Merton's thesis: Apostolic spirituality and the establishment of the Jesuit scientific tradition*, «Science in Context», 3 (1989), pp. 29-65.

³ Rivka Feldhay, *Knowledge and salvation in Jesuit culture*, «Science in Context», 1 (1987), pp. 195-213.

He insisted that mathematics is a true science, against contrary opinions predominant in the traditional circles of those times, and that they are totally necessary for the study of natural philosophy. The introduction of mathematical sciences as an important element in the programs of Jesuit colleges was also an answer to the growing social importance that modern science was acquiring. Christopher Scheiner was aware of this social demand and of its apostolic importance. In a letter to Johannes Rader he observed that the study of mathematics should be more highly valued among Jesuits. To Paul Gudin, professor of mathematics in the college of Graz, he wrote: "It is evident that mathematics are the nets with which one can catch the elites and nobles and bring them to God's service"⁴. The novelty of Jesuits' dedication to mathematical sciences is manifested in the brief sent to the King of Spain Felipe IV by the professors of the universities of Salamanca and Alcalá de Henares, regarding the upgrading of the Jesuit college in Madrid, Colegio Imperial, into the category of Reales Estudios (Royal Studies) with university rank. They were opposed to the royal plans and argued that it was neither convenient nor "decent" for religious to teach such profane matters as mathematics, astrology, navigation and military science. Jesuits answered that they could justly teach these subjects as they were part of the programs of an ecclesiastic and religious school, and that they were necessary for teaching philosophy and that they serve to avoid "the abusive use by the general public in their forecasts and superstitions"⁵.

After the restoration of the Society of Jesus in the 19th century, the presence of Jesuits in science was also justified as an apologetic argument against those who attacked the Church in those times as an enemy of science. The presence of Jesuit scientists and the existence of their scientific institutions was presented as a clear argument against those false accusations and as an example of the compatibility between science and Christian faith. Aloysius Cortie (1859-1925), director of the Stonyhurst Observatory, writing in 1923 about Angelo Secchi noted:

The enemies of the Holy Church have made such unwarranted use of science as a weapon of attack against her most fundamental truths, that an impression has sometimes been introduced among many of her children that the pursuit of science is damaging and dangerous to faith...Father Secchi is a striking example of one who knew how to unite religion and science⁶.

Besides these historical elements bound to the apostolic needs in the educational work in colleges and universities, we should look for some more specific intrinsic elements of Jesuit spirituality. Some elements of the apostolic spirituality can be also found in other modern religious orders (founded after 17th century) of apostolic character, some following the Jesuit example, which don't have a similar presence in science. We have, then, to look for some more specific elements in the Jesuit apostolic spirituality in order to explain this peculiar scientific tradition⁷. We can find the fundamental lines of the so called "Ignatian spirituality", based on the

⁴ Steven J. Harris, *Les chaires de mathématiques*, in Luce Giard, *Les jésuites a la renaissance*, 1995, pp. 253-254.

⁵ José Simón Díaz, *Historia del Colegio Imperial de Madrid*, Madrid 1952, pp.72-84.

⁶ A. L. Cortie, Angelo Secchi, S. J. (1818-1878). In B. Windle (ed.) *Twelve catholic men of science*, London 1923, pp. 149-164.

⁷ Udías, *Searching*, cit., pp. 7-12.

ascetic and mystic experiences of Saint Ignatius, in his two great works: the *Spiritual Exercises* and the *Constitutions*⁸. The spiritual exercises, a body of prayers and meditations made for one month at the beginning and the end of the training of every Jesuit, and repeated during eight days every year, form the core of this spirituality. There we should search for the motivations which can explain the especial dedication of Jesuits to science. The most important characteristics of the Ignatian spirituality is a mystique of service, understood as a service to God through the apostolic ministry to men⁹. The Constitutions define the aim of the Society of Jesus “not only to assist the salvation and perfection of its own members by the divine grace, but with the same grace intensely to assist the salvation and perfection of their fellow men”¹⁰. For St. Ignatius this service is understood as a service to the Church. He often repeated in his writings what has become the motto of the Jesuits, that all should be done for the “greater glory of God” (*Ad maiorem Dei Gloriam*). This can be found already in Saint Paul, “do all for the glory of God” (1Cor 10,31), but St. Ignatius added the comparative “greater” to indicate that Jesuits should seek not only the glory of God but the greater glory. In the first meditation of the *Spiritual Exercises*, “Principle and Foundation”, he exhorts that one should act in every occasion «desiring and choosing only what is most conducive for us to the end for which we were created»¹¹. The term “more” (*in latin magis*) is an important peculiarity of this spirituality. At any time and circumstance this spirituality motivates Jesuits to seek this “more” in their work. Many Jesuits found it in scientific work.

St. Ignatius stresses also often in his writings about “finding God in all things”, meaning a growing awareness that God can be found in every person, in every place and in everything, pointing with this to an attitude of prayer in active life. This is an important aspect present in the last meditation of the *Spiritual Exercises* the “Contemplation to attain love”. In this meditation we one is asked «to look how God dwells in creatures, in the elements, in the plants, in the animals, in men [in me, myself], [...] and to consider how God works and labors for me in all things created on the face of the earth». This makes all things, people and circumstances occasions for finding God. Moreover, St. Ignatius by stressing also the humanity of Christ invites one to see that everything human, and there we can include science, can serve for our encounter with God. Jerónimo Nadal, a companion of St. Ignatius, refers to this attitude with the expression “contemplatives in action” for what has been called the “Jesuit way”. This implies a union between prayer and action; we can find God in the silence of prayer and in the activity of work. There is, then, no activity, no matter how profane it may look, that cannot be transformed into prayer. Teaching mathematics or physics in a university, observing the light from a distant galaxy or drawing a map of an unknown region are activities that a Jesuit finds perfectly compatible with his vocation and through which he can try to find God in his life. In other religious groups, this may also be their personal attitude, but for Jesuits this attitude stems from the core of their spirituality. Angelo Secchi, the renowned astrophysicist, acknowledged this saying: “The contemplation of

⁸ San Ignacio, *Obras Completas. Edición Manual*. Madrid 1991, pp. 221-238, 432-646.

⁹ Jean-Claude Dhôtel, *La spiritualité ignatienne. Points de repère*. Paris 1991.

¹⁰ S. Ignacio, *Obras, (Examen Primero y General, Cap. 1. 3)*, p. 466.

¹¹ St. Ignacio, *Obras, (Ejercicios Espirituales, [23])*, p. 229.

God's works is one of the noblest works of the spirit; this is the principal aim of the study of nature"¹². In this way Jesuits involve themselves in activities, among them scientific research, which others consider incompatible or at least not convenient for religious. We can find them active in social work, as parish pastors, carrying out research in biology or astrophysics or writing poetry, all motivated by the same spirituality of seeking God in all things.

Another aspect of the Ignatian apostolic spirituality is its preference for getting into situations and activities that we can call "frontier work". By this we mean that Jesuits instead of dedicating themselves to traditional pastoral activities inside the Church, they try to get in contact with those outside activities sometimes considered to be non-conventional. Pope Benedict XVI recognized this when he told the Jesuits:

As my Predecessors have said to you on various occasions, the Church needs you, relies on you and continues to turn to you with trust, particularly to reach those physical and spiritual places which others do not reach or have difficulty in reaching¹³.

This explains how we can find a Jesuit praying in a Buddhist monastery or carrying on physical research in a particles accelerator. Jesuits are always driven to frontiers, to places and situations where the Christian message is not yet known. For example, this spirit drove Mateo Ricci and his companions in the 17th century to present themselves in the imperial Court of China as astronomers of the West, adopting the dress and manners of the Chinese scholars. In the 19th century and beginnings of the 20th century, science was considered to be a field alien, if not hostile, to religion. Jesuits felt the responsibility to show with their scientific work that there is no incompatibility between science and faith and that scientific work itself can also be a vehicle to find God. From this expectation emerged the foundation of the network of Jesuit observatories spread out around the world. The modern Jesuit scientist considers the scientific community as his parish, breaking with his presence many barriers of estrangement or a lack of understanding. Daniel Linehan (1904-1987), a tireless seismologist and explorer, aware of his function as priest and scientist, engraved on the base of his chalice: "First Mass at Magnetic North Pole 1954" and "First Mass at South Pole 1958". He was very clear what his priorities were when he told a journalist from Life magazine: «I would give up all my seismology, to celebrate one such Mass as you came to this morning»¹⁴.

3. Jesuit scientists' testimonies.

Jesuit scientists of the 17th to 18th centuries didn't feel the need to justify their activities which they considered to be perfectly normal. Some modern Jesuit scientists, however, did consider it necessary to write about the subject. Secchi was among the firsts to do so. He found his work to be an expression of the compatibility between science and religion, a controversial subject at those times: "True faith is not hostile to science, but both are like two rays coming from the same Sun which should illuminate our mind by

¹² Angelo Secchi, *Le soleil*, Paris 1875, (*Prologue*), 6.

¹³ Papal address of Benedict XVI to General Congregation 35.

¹⁴ Charlotte B. Harvey, *The voyage of the Monte Carlo*, Fall 2000.

the way of truth”¹⁵. Teilhard de Chardin, commenting to a group of young Jesuits on the letter of Father General Johannes Janssen of 1947 about the intellectual apostolate, presented what he thought of the dedication of Jesuits to science in the context of his thought¹⁶. He began by stressing the enormous importance of science in the modern world saying that it has become what he calls the *Grande Affaire du Monde*, a «human function so vital as nutrition and reproduction». For him scientific research constitutes the arrow head of human evolution. He asked himself why is it so important for us Jesuits to share in scientific research and answered that «this is the form under which the creative power of God is hidden and operates more intensively in nature around us» Through it, he adds, new increases of conscience appear in the world. Teilhard is convinced of the need of the reconciliation of the “problem of the two faiths”, faith in God and faith in man. This reconciliation is needed in order to advance the Kingdom of God in the world. For him, these two faiths are in fact the two essential components of a complete human-Christian mystic. Their reconciliation and synthesis cannot be made present in the world unless it is concretely lived and thus the importance of the scientific research of Jesuits. Teilhard ends saying: «We Jesuit priests not only should be interested in scientific research, we must believe in it, since only there the human-Christian mystic develops on which a human unanimity can be established in the future»¹⁷. Thus, we can find, under a different formulation, the same Ignatian spirituality which finds in scientific research the best means leading to the expansion of the Kingdom of God with the reconciliation of the two faiths. Teilhard expresses in his well-known essay, *Mass on the world*, a different formulation of the Ignatian principle of finding God in all things¹⁸. In this prayer he consecrates all human efforts and sufferings to God as a universal host on the altar of the world.

In the 1960’s there were a good number, nearly 300, of Jesuit scientists in the United States. This motivated some of them to explicitly pose the question about the vocation of the priest-scientist and the Jesuit-scientist. This was a particular aspect of a more general problem of what was called at that time the hyphenated priest, that is, the priest with other professional activities. Frank Haig, a professor of physics, considers that the priest-scientist cannot be only explained by personal interests or by the apologetic role of defense of the Church¹⁹. For him these are necessary but not sufficient reasons and he proposes that the priest-scientist has primarily a symbolic role in the integration of a life of science and a life of grace. He justified this integration with the need present today in the Church for rethinking its message in the language of the scientific world and thus to be present on the frontiers of knowledge. According to Haig the priest-scientist “attempts to make the world of faith and the world of science

¹⁵ V. van Tricht, *Le Père Secchi*, «Revue de Question Scientifiques», 4 (1878), pp. 353-402, 370.

¹⁶ Teilhard de Chardin, *Sur la valeur religieuse de la recherche. Science et Christ. Oeuvres* 9, Paris 1965, pp. 255-263.

¹⁷ *Ibid.*, p. 263

¹⁸ Teilhard de Chardin, *La Messe sur le monde. Le cœur de la Matière, Oeuvres* 13, Paris 1976, pp. 139-156

¹⁹ Frank. R. Haig, *Vocation of the priest-scientist. Bull.*, «American Association of Jesuit Scientists», 36 (1961), pp. 3-21.

transparent to each other”. Ernest Spittler, a professor of chemistry, applies these thoughts to the concrete case of Jesuits and puts at the center their role as priests the mediators between God and men²⁰. This role must be realized inside the Church and is “mediatorial” to the scientific community, to the Catholic laity and to the non-Catholic. It constitutes a true apostolate, but often a hidden one, and for the Jesuits it will most often be realized in educational work. William Meissner, a psycho analyst, makes a more direct application to the Jesuit-scientist who adopts two roles, of a priest and of a scientist and says that this places one in a situation which is not free of conflict, frustration, insecurity and anxiety²¹. To solve these conflicts he proposes the need to integrate the values of science with the values of Jesuit life. The priest-scientist is primarily a priest and exercises a specifically religious function which is at the same time apostolic and symbolic. It is apostolic insofar as he comes across as one who bears testimony to truth. It is symbolic insofar as he embodies the fullness of the Christian religious life: «He symbolizes, then, the unification in truth of religious and scientific knowledge, of faith and reason, of Catholic wisdom and secular learning, of the Church and modern science». Meissner presents what is specifically Jesuit in what he calls the “Jesuit proposition” that we can understand as meaning the Jesuit spirituality. He begins by considering the means by which the end of the Society of Jesus are to be pursued, as proposed by St. Ignatius in the Constitutions, some which are supernatural and other natural²². Applied to the Jesuit-scientist this means the complementarity of the religious ideal of personal sanctity and his dedication to science. For a Jesuit, scientific work must be always apostolic and Meissner interprets this as being “incarnational,” that is, sharing in the presence of the incarnate Word of God among men for the sanctification of all human activity. He recognizes the difficulties in carrying out this function which must be a dynamic synthesis between being, in an authentic sense, a man of God and a man of science. This is a complex role, Meissner admits, and consequently there will be always a certain tension in the life of a Jesuit-scientist.

Timothy Toohig, a Jesuit working on particle physics at the Fermilab, tries to find the connection between his work as a physicist and his spirituality²³. He starts with the consideration that physics seeks to understand the ultimate structure of matter, its elementary constituents and the forces that bind them as well as the origin and final destiny of the universe. For this reason, he says, we shouldn't be surprised that physicists like Albert Einstein and Werner Heisenberg and more recently Stephen Hawking and Steven Weinberg in some of their writings consider problems concerning the ultimate questions of existence and end up talking, in one way or another, about God. Toohig tries to show that there is a certain analogy between the work of physicists and the search for God. He examines how Einstein and Niels Bohr recognize the presence of a hidden mystery behind the structure of the universe which remains always open to new

²⁰ Ernest G. Spittler, *The priest-scientist in the Church. Bull.*, «American Association of Jesuit Scientists», 39 (1962), pp. 30-37.

²¹ William W. Meissner, *The Jesuit as a priest-scientist, Bull.*, «American Association of Jesuit Scientists», 40 (1963), pp. 25-33.

²² San Ignacio, *Obras*, (*Constituciones X*, 3, 813-814), pp. 641-642.

²³ Timothy E. Toohig, *Physics research, a search for God.* «Studies in the Spirituality of Jesuits», 21/2 (1999), pp. 1-26.

intuitions and inspirations. Both, according to Toohig, held an intuitive approach to physical problems and proceed in their work with a deep faith in the existence of an underlying simplicity in the structure of matter. He asks himself if these attitudes are not pointing to an underlying spirituality and to a certain implicit experience of God. Toohig in his analysis uses the concept of “transcendental experience” developed by the German Jesuit theologian Karl Rahner, meaning an experience of the transcendence present in every person which constitutes in itself an “unthematic and anonymous knowledge of God”. Toohig thinks that there is a similitude between this transcendental experience and the experience of physicists brought face to face with the mystery of the universe. He affirms that though anonymously, physics research can be considered as a search for God. This similitude may be questionable, but his intention to find a certain “religious” sense in the scientific experience itself may be compared with the Ignatian proposal of finding God in all things. Toohig also presents analogies between certain other aspects of the Ignatian spirituality, for example, the experience of personal redemption at deep levels of life, as presented in the Spiritual Exercises, and the hunger for an ever deeper penetration of the mystery of the universe in physicists’ lives. He even dares to suggest that there is a certain similitude between Einstein’s experience in the discovery of new physical theories and St. Ignatius’ mystic experience about creation beside the Cardoner River.

More specific is the approach of José Gabriel Funes, present director of the Vatican Observatory, who begins by stating that the Jesuit scientific tradition has its roots in Jesuit spirituality²⁴. He discusses the challenges to the Christian faith that science poses today and the call to the “scientific apostle” to be present at the frontiers between the Church and the world of science and offers his own testimony that there is no true conflict between them. To the practical objection that there are for a priest today other more urgent problems, Funes answers with the incident of the anointing of Jesus in Bethany (Mc 14, 3-9) to justify what can be considered as a life “wasted” in the study of galaxies, but accomplished in the service of the Lord. He ends with the idea, already mentioned by others that the priest-scientist serves as a bridge between the Church and the scientific community. Another member of the Vatican Observatory, Paul Gabor tries to answer the question: Is Jesuit involvement in science an expression of the Jesuit identity itself, i.e. of the Order’s charisma, or is the result external influences²⁵? He begins with a review of the scientific work in the Society from Clavius in the 16th century to the General Congregation 31 in 1961. Analyzing the motivation behind this work, Gabor presents first the external motivations, such as those apologetic and utilitarian which he considers not sufficient. Then he examines the internal motivation and connects scientific research with Jesuit spirituality in St. Ignatius’ Constitutions and Spiritual Exercises. Gabor states that “science is done in the Society for its own sake as a true spiritual quest”. Thus, he claims that extraneous reasons as pragmatic, pastoral, pedagogical and spiritual are not necessary and the fundamental

²⁴ José G. Funes, *Una imagen evangélica para el apostolado científico* (Mc 14, 3-9), «Rev. de Espiritualidad Ignaciana», 37, (2007) 87-95.

²⁵ Paul Gabor, *Jesuit identity and science. An inside look*, in En Petra Čemus (ed.) *Proceedings of the Bohemia Jesuitica Conference* (Prague 25-27 April 2006) Prague 2010, pp. 647-660.

motive for Jesuit scientists is research itself. He asserts also that one can find many parallels between scientific life and the spiritual life. Regarding physics in particular, Gabor finds that there are several aspects of work in physics, such as playfulness, sapiential knowledge and the ethical and ascetic implications and dimensions that show its spiritual affinities. He ends saying that “there is an unmistakable affinity between science and Ignatian spirituality”.

In these few testimonies we have seen that Jesuit scientists themselves see their activity not only as compatible with but as a consequence of the Ignatian spirituality and justified by itself and not only by apostolic or utilitarian motivations. We have also seen that there is a true effort to show the affinity between the scientific work and this spirituality, though it is not completely clear in what this affinity consists. Gabor recognizes that there are testimonies rather than in-depth analyses but finds frustrating the lack of systematic studies concerning the spirituality of scientific work. Funes states that among Jesuits there are different ways to spiritually live the scientific apostolate, as there are many different ways to live the Jesuit vocation itself. As an example, he presents the differences between Matteo Ricci and Teilhard de Chardin, and he identifies himself more with the former²⁶. All testimonies start with the premise that for much of its history Jesuits have distinguished themselves in the Church as belonging to the institution which has had and still has a special dedication and involvement in science. They conclude that, in some way, this involvement must be related to Ignatian spirituality, which is the foundation of Jesuit life, though this relation is expressed from different points of view and that further studies are needed.

4. Science practice and Jesuit life

There is still a question we must consider about how dedication to science was actually lived by Jesuits in the context of their own religious order and how was it seen by other Jesuits, especially, by their superiors. In the first place, we have to take into account that scientists were and are always a small minority among Jesuits. Their training somehow separates them from the rest of their brethren, mainly dedicated to theology, philosophy and humanities or to direct pastoral work. It is true that they have followed a similar theological and philosophical training, but their scientific training and work is not shared by the rest. This explains that sometimes the Jesuit scientist may feel himself a little misunderstood or isolated in his work, somewhat like an outsider in his own community. Superiors also sometimes regret they cannot dedicate scientists to other works they consider more useful.

Mordechai Feingold examines in detail the situation with Jesuit scientists in the 17th and 18th centuries and he asks: why among them there are no first line scientists like Galileo, Descartes or Newton²⁷? Though we may dispute the relevancy of the question, since scientists at that level are so rare that it is difficult for an institution to contribute even one of them. But the question has Feingold examine a series of circumstances that place obstacles in the activities of Jesuit scientists. He even wonders whether there

²⁶ Funes, *Una Imagen*, cit., p. 92.

²⁷ Mordechai Feingold, *Jesuits: Savants*, in M. Feingold (ed.), *Jesuit science*, cit., pp. 1-45.

is not a real incompatibility between the Jesuit vocation and the dedication to a secular science, since for them science is always a means to an end and not an end in itself. We have to admit that for a Jesuit scientific work, as any other activity of a Jesuit, is finally oriented to the apostolic end of the salvation of the souls. However, this doesn't invalidate their dedication to science, since even the greatest scientists had a variety of motivations in their work.

The purity of the pursuit of science for its own sake is actually a little myth, as has been shown by the sociologist of science Robert K. Merton²⁸. Feingold examines a series of practical problems which might place obstacles in the progress of the scientific career of a Jesuit. Among them he points to the little interest of the superiors for this type of studies and the urgency to attend to other things considered more important. A concrete instance is the precedence given by superiors to the teaching needs in the colleges and universities over research. This problem shows itself also in the priority given to the publication of textbooks over those of research. Feingold states that Jesuits excelled more as professors and trainers of others in science than as researchers by themselves. For example, students in Jesuit schools being scientists like Torricelli, Descartes, Laplace, Volta, Buffon and Lalande. Other obstacles in the scientific work of Jesuits, according to Feingold, are the superiors' warning against novelties, the rules for the unity of doctrine, the interior censorship of the order and the autocensorship of the authors themselves. A concrete problem that affected Jesuit scientists in the 17th and 18th centuries was the acceptance of the Copernican system in astronomy and of atomism in physics. We have to accept the presence of these problems, recognized by the Jesuit scientists themselves, but they were not insurmountable obstacles. Also, we cannot separate so drastically teaching and research; if Jesuits were so good science teachers was because they united teaching and research.

Jesuit scientific work in the restored Society after 1814 was largely centered in observatories and universities. In these years there were no longer prejudices against scientific theories since science separated from philosophical and theological questions. Jesuit scientists had complete freedom in their work in scientific fields. For example, Teilhard de Chardin never had any problems with the publication of his scientific work. Moreover, superiors advised him to stay in the scientific field and not to enter theological questions. Work in the new observatories, founded after 1824, was highly esteemed by Jesuits and fostered and encouraged by superiors until the s 1970's, when it began to decline. In 1893 Father General Luis Martin referred to the work done in the Observatory of Manila (Philippines) saying that it contributed not only to the "splendor of science and the good name of our Society, but also to the utility of scientists and the help of souls, which is the end of all our studies and work according to our institute"²⁹. Pierre Lejay (1998-1958), director of the Observatory of Zikawei (China), complained in 1933 that the scientific work of the observatory was not sufficiently appreciated in the Jesuit Chinese Mission and that some missionaries considered it a waste of time. Father General Wlodmir

²⁸ Robert K. Merton, *The sociology of science. Theoretical and empirical investigations*, Chicago, 1973, chap. 15.

²⁹ *Archivum Romanum Societatis Iesu (ARSI), Letter to Fr. Miguel Saderra (3 Nov 1893), Letters of Fr. Luis Martín, 1892-1906, pp. 158.*

Ledochowski wrote to him telling him that «he personally has always protested against this unjust opinion» and pointed to «the high importance of the intellectual work and the appreciation it has always had by the Church and the missionary traditions»³⁰. We can conclude that scientific work still enjoys a general high esteem among Jesuits, except for some critics who don't understand its importance.

In modern times the emphasis on teaching, which we saw in the previous period, is still present, owing to the increase in the number of universities managed by Jesuits and the need of the presence of Jesuit professors in the departments of science. Ernesto Gherzi (1886-1976), last director of Zikawei Observatory and afterward working at the Jesuit Geophysical Observatory in Montreal, complained in 1970 about the little support he found among other Jesuits in his geophysical research. Louis Larendeau, Provincial of the Jesuit French Canadian Province, acknowledged that often superiors are not familiar with the world of science so that the vocation of Jesuit scientists is often unrewarding, especially for those that dedicate themselves to research. Teaching, however, he concedes, is more recognized and accepted³¹. Carl-Henry Geschwind writing in the context of modern Jesuit work in seismology in the United States considers also, like Feingold, whether Jesuits worked in science for its sake or were they seeking other ends. He states that in the 19th century Jesuit scientific tradition had faded away and that in North America «an ideological distaste for unfettered research» developed³². This is to ignore figures like Angelo Secchi, Stephen Perry and Benito Viñes who in the 19th century made significant and lasting contributions to astrophysics, geophysics and meteorology. He contrasts the attitudes toward seismological research of Frederik Odenbach and James Macelwane, considering that only the latter had a true scientific mentality. We have already mentioned the complexity of the motivations in scientific work and how the presence in Jesuit scientists of an ultimate religious end doesn't invalidate their work as scientists.

Conclusion

We have seen how Jesuits from the early days of their founding in the 16th century have shown a continuous and institutional commitment to the natural sciences unparalleled by any other religious order in the Catholic Church. This work had different characteristics in the two periods of the Jesuit history, the first between 16th and 18th centuries and the second from the 19th century to the present. The foundation of the Society of Jesus coincides with the beginning of modern science and in consequence Jesuits introduced the new approaches of mathematical and experimental science in their educational work in the network of their schools, colleges and universities. The presence of Jesuits in science has continued along their whole history. Besides pragmatic and apostolic motivations, one can find a

³⁰ ARSI, *Letter to Fr. P. Pierre Lejay* (17 April 1933). *Letters by Fr. Wlodimir Ledochowski*, 1915-1942, pp. 482-483.

³¹ *Letter of the provincial of the French Canadian Province Louis Laurendeau to Fr. Ernesto Gherzi* (Montreal, 3 February 1970) Saint-Jérôme, ASJCF, pp. 214-235.

³² Carl-Henry Geschwind, *Embracing science and research. Early twenty-century Jesuits and seismology in the United States*, «Isis», 89 (1998), pp. 27-49.

foundation for this work in Ignatian apostolic spirituality. The core of this spirituality is the stress in finding God in all things, the union of prayer and work, the search for what leads to the greater glory of God and the preference for the work on the frontiers. This has often involved Jesuits in unconventional activities and situations such as scientific research. Jesuit scientists reflecting on their work acknowledge also this especial affinity between science and their spirituality and are aware of the difficulties of this vocation, being at the same time priests and scientists.