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"Truth is Catholic; proclaim it ever, and God will effect the rest."—BALMEZ.

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SCIENCE IN ROME.

Father Zahm's Paper on the Vatican Observatory.

THE LATE FATHER DENZA.

It was not merely because astronomy was a fascinating science that it was studied with ardor by saints and doctors. Aside from the inspiration afforded by the contemplation of the wonders of the starry vault, there were also practical considerations which moved the authorities at Rome to encourage the study of the heavenly bodies. Chief among these were the demands of chronology, and the necessity of accurately regulating the various festivals of the ecclesiastical year. As far back as the time of St. Polycarp, in the second century, there was a dispute as to the time when Easter should be celebrated. The question was taken up by Pope Leo the Great, and, later on, by Nicholas V., Sixtus IV., and Leo X., but without any satisfactory results. Not until 1582 was the controversy settled, when Gregory XIII. promulgated the reformed calendar and made it obligatory throughout the Catholic world.

The building in which the work of the reformation of the calendar was executed forms a portion of the immense pile of buildings in Rome known as the Vatican. The upper portion of the structure, in honor of its projector, Gregory XIII., is called the Gregorian tower. Connected with the Vatican library, and, indeed, forming a part of this wing of the Papal palace, it rises considerably above the adjacent portions of the edifice. It is a large and massive structure, containing more than a score of spacious apartments, and, in every way, well adapted for the purposes of astronomical work.

The room in which the calendar was reformed is preserved in essentially the same condition in which it existed in the time of Gregory XIII. It is remarkable not only for its size, but also for the beautiful frescoes which adorn the walls and ceiling. These, although several centuries old, are still in an excellent state of preservation, and fully in keeping with the other admirable works of art, which constitute so conspicuous a feature of the magnificent palace of the Vatican.

In the floor, in the centre of the chamber, is a large slab of marble in which is executed the celebrated meridian of the noted Dominican, Ignazio Danti, one of the commission appointed for the reformation of the calendar. By means of this meridian and a small aperture in the wall, through which a solar beam was permitted to enter, he was able to demonstrate the necessity of reforming the calendar, and the exactness of the system proposed by one of his associates, Luigi Lilio, of Calabria. The calendar room, as it is called, is now used for the weekly meetings of the Vatican Astronomical Association, a society composed of the staff of the observatory, together with a number of other savants interested in the advancement of astronomy, meteorology, and terrestrial magnetism. These sessions are usually presided over by

his Eminence Cardinal Mocenni, assistant secretary of state, who is the Pope's ordinary representative in the management of the observatory.

It was reserved for Leo XIII. to bring to a successful issue what had before been so frequently attempted but without serious or lasting results. On the occasion of the memorable Vatican exposition, held in 1888, in honor of the fiftieth anniversary of Leo XIII.'s elevation to the priesthood, the idea of reorganizing the observatory took a definite and practical form. The building was immediately renovated and enlarged. In a short time, not only was the building in condition, but the instruments were in place, and everything in readiness for systematic and continuous observations according to the latest and most approved methods.

That the observatory might not again be exposed to the vicissitudes which had marked its previous history, Pope Leo endowed it with a sum ample to meet all current expenses, and set aside certain portions of the Vatican palace and gardens for the special use of the observatory. Near the Gregorian tower he gave a suite of rooms for the reception of a large heliograph and its appurtenances. This instrument, used for photographing the sun, is an exact duplicate of the one employed by Janssen in his observatory at Meudon. Besides the rooms reserved in the Gregorian tower for meteorological observations, place for such observations was likewise provided at a lower level in the Vatican gardens.

But by far the most important addition to the previously existing observatory was the famous Leonine tower on the summit of the Vatican hill. This was constructed in 848, by Leo IV., as a fortress against the inroads of the Saracens, and is admirably adapted for the purposes of an observatory, being remarkably free from vibration, and possessing a clear horizon.

In solidity this venerable tower is almost comparable with the pyramids of Cheops and Chefnen. Its internal diameter is nearly sixty feet, while the walls at the base are no less than fifteen feet in thickness. There are three stories, two of which are arched over with heavy masonry, whilst the third supports a large revolving cupola of the latest design and best construction. This structure is about a quarter of a mile distant from the Gregorian tower, and offers one of the most beautiful and commanding views to be had anywhere in the Eternal City. It is, indeed, from this point that one sees St. Peter's as it was conceived by Michael Angelo, and as the great architect desired it to appear from all sides. Owing to a change in the plan of the building, made without his approval, the magnificent dome of the great basilica is not seen to advantage from the front. It must be viewed from the rear to have an accurate idea of its grandeur.

Leo XIII., as founder of the Vatican observatory, has always manifested the liveliest interest in the work which is there being accomplished, and is ever ready to do anything in his power which may subserve its interests or conduce to its betterment. I shall never forget the enthusiasm with which he spoke of his specula—the Italian word for observatory—on the

occasion of an audience which I recently had, nor the profound interest which he exhibited in the general advance of astronomical science. He is thoroughly informed as to what is being done, and feels a satisfaction in the fact that the specula Vaticana was one of the first to propose participation in the international undertaking of photographing the heavens.

When I spoke to His Holiness of my intention to write an article on the observatory for *The Cosmopolitan*, he seemed specially pleased. "Va bene"—good—he said. "I trust you will find it compares favorably with other observatories." I replied that, having visited the chief observatories of Europe and America, I was in a measure familiar with their equipment, and that the observatory of the Vatican bore comparison with the best of them. "I am glad to hear this," resumed the venerable pontiff, "for I am much interested in the observatory and the work which is being done in it; and it is my desire that it shall in no wise be inferior to the most noted of the world's observatories. A noble study is the science of the stars, and one which cannot be pursued with too much ardor." Leo XIII. attaches the greatest importance to the study of astronomy, and has at heart the cultivation and advancement of science in general.

But much as has been done for the observatory by the Pope and by Cardinals Rampolla and Mocenni, it could not have won the distinction it now enjoys but for its learned, zealous, and indefatigable director, Padre Denza.

From the opening of the observatory until a few weeks ago, when death suddenly put an end to his brilliant and useful career, the illustrious Barnabite was the soul of the observatory so far as the scientific world was concerned. It was he with whom astronomers and the directors of other observatories had to communicate when they desired information respecting the work which was being conducted. A profound mathematician, a skilful observer, a patient investigator, an ardent lover of nature, he was in every sense of the word, an ideal astronomer, and as such he was recognized by his colleagues throughout the world. Besides this, he had a prodigious capacity for work, and a genius for invention that would have made the fortune of another man. Indeed, some of the most valuable and ingenious instruments in the observatory are the product of his fertile brain. With all this, he was likewise a prolific writer. The author of numerous and valuable works on astronomy, geodynamics, and meteorology, he was besides a regular contributor to divers scientific publications of both Italy and other countries. The founder of the Italian Meteorological Society, and for the past third of a century its director-general, he was also a member of a large number of scientific associations in foreign lands. The rival of his illustrious friend, Padre Secchi, whom he resembled in many traits of character; the friend and confidant of Leo XIII., who keenly feels the loss of his devoted astronomer, Padre Denza leaves behind him in his contributions to science "a monument more lasting than brass, and more sublime than the regal elevation of pyramids." He was, indeed, a true votary of astronomy, and it will be

long before the void occasioned by his untimely death can be filled. "Bravomo!" said Leo XIII. of him, in speaking to me only a few days before his demise. "Vir rei astronomicæ et physicæ scientissimus."—a man thoroughly versed in astronomy and physics—his friend wrote to him in the brief announcing the establishment of the observatory of the Vatican. And no one who is familiar with the life-work of Padre Denza will impugn the truth of this characterization, eulogistic as it is. As to his associates in the astronomical world, they will, I am sure, endorse it as a truthful tribute. From Greenwich to Rio de Janeiro his death will be deplored as a loss to science.

The assistant director of the Vatican observatory, and Padre Denza's probable successor, is Padre Lais, who has already achieved marked distinction as a conscientious and successful investigator. Like his lamented master, Padre Denza, he is a ready and prolific writer, as well as a careful observer, and is the author of many contributions on astronomy and meteorology which are of acknowledged merit and permanent value.

But important as are the achievements of the working staff of the observatory—they are nine in number, all told—we cannot lose sight of him who made these possible. After a visit to the observatory, I was returning from the Leonine tower, where I had left Padre Lais engaged in his work of love—photographing the stars—a prisoner for the night on his reclining chair, under the eye-piece of the superb equatorial. Slowly I wended my way through the solitude of the Vatican gardens, where all was solemn stillness, and passed around the imposing temple of St. Peter's. Presently I found myself hard by the venerable Egyptian obelisk in the Piazza di San Pietro. It was near the hour of midnight, and the piazza was entirely deserted. But high up in the Vatican the light in the Pope's study was not yet extinguished. Since he ascended the chair of Peter, Leo XIII. has been untiring in his efforts to bring out in bold relief the natural and necessary alliance between science and faith.

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