Francisco Díaz Covarrubias (1833-1889): a 19th century Mexican astronomer.

19th century astronomy was dominated by the interest to determine with great accuracy the position of the stars and the measurement of time. The relationship between these issues and mapping is very close, which made some of those studying surveying engineering or geographical engineer in Mexico develop a great interest in astronomy.

Undoubtedly Francisco Díaz Covarrubias was the most prominent Mexican astronomer of the 19th century. And the highlight of Mexican astronomy in this century was the observation of the transit of Venus across the Sun, in 1874, in Yokohama, Japan, discovered by Díaz Covarrubias and his team.

Francisco Díaz Covarrubias was born Jan. 21 in 1833 in Jalapa. He studied at Colegio de Minerías, where he graduated as an engineer surveyor. And in 1854, being 21 years old, he was named teacher of the subjects of geodesy, topography and astronomy at the Minerías seminar. In 1855, he determined the latitude and longitude of Querétaro city by astronomical observations. He also directed the creation of the geographical map of the Valley of Mexico. And in 1857, he specified the longitude and latitude of the country's capital. Accurately, he calculated the solar eclipse of March 25, 1857, which was observed in Mexico City. For him, this event was a great triumph, as the eclipse hadn't been predicted by the time of calendars.

In September 1862 he was appointed director of the Astronomical Observatory in Chapultepec, which was owned by the federal government and was installed in January 1863. Given the imminence of the French army entrance to the Mexico City, Díaz Covarrubias dismantled the main instruments of the observatory and moved to San Luis Potosí and later to Tampico.

He flatly refused to work for the government of Maximilian I. This is explained by the Juárez tradition of his family. His brother José, born in 1837, was a brilliant poet, novelist and surgeon who joined the liberal army as a doctor and was caught and shot by Marquez troops after the battle of Tacubaya, on April 11, 1859, and died as one of the martyrs of Tacubaya. His brother Juan, a supporter of compulsory, free and secular education was Secretary of Public Education (1873-1876) during the President's Sebastián Lerdo de Tejada government. Her sister Adelina was Gabino Barreda’s wife, first General Director of the National Preparatory School.

In 1867, after the victory of the Republic, Díaz Covarrubias was appointed by Juárez as senior officer of the Ministry of Development, a position he held until 1876. The same year, along with President Juárez, he checked the status of the astronomical instrumentation in Chapultepec. Due to the damaged equipment and property they decided to put off the reinstallation of the Astronomical Observatory in Chapultepec.
Diaz Covarrubias assisted Gabino Barreda in the installation of the National Preparatory School (1867) and was a member of the committee that developed the curriculum. From 1869 he was deputy director, and in 1871 was appointed director of the College of Mathematics at the same school.

Despite the political activity and the position in the National Preparatory School, he never stopped studying astronomy and in 1867 he published his book "New astronomical methods for determining geographic time, azimuth, latitude and longitude." In 1870, he published his book "Treaty of surveying, geodesy and astronomy" dedicated to the students of the Mining School, the third edition of this work appears in 1896. In 1873 he published a math book, "Elements of transcendental analysis or infinitesimal calculus", dedicated to high school students. These two books were used as texts of the respective subjects for over thirty years.

With the support of President Sebastián Lerdo de Tejada (1823-1889), in 1874 Diaz Covarrubias organized the Mexican expedition to observe the transit of Venus across the Sun to be held on December 8. The place on the planet where this phenomenon would be observed optimally was Japan, therefore a delegation was formed for this purpose which was composed by Francisco Jiménez, Agustin Barroso, Manuel Fernández Leal and Francisco Bulnes, led by Diaz Covarrubias. A detailed account of this journey is presented in the book of Moreno (1995).

The transit of Venus across the Sun's surface is a rare phenomenon because the plane of the orbit of Venus around the Sun is inclined relative to the plane of the Earth's orbit, which means that when Venus passes between the Earth and the Sun the vast majority of the time you look in the sky to the north or south of the Sun, without passing through the solar surface.

The transit occurs when between Earth and the Sun, Venus crosses the plane of the Earth's orbit, then Venus is seen on the surface of the Sun moving from east to west. Transits of Venus occur in pairs separated by intervals of about eight years. In the 19th century transits of Venus occurred in 1874 and 1882, in the 20th century there were none, and in the 21st century the first pair occurred on June 8, 2004 and the second will occur in June 5 or 6, 2012 depending on where you look, in Mexico it will take place on June 5.

The importance of the transit of Venus in the 19th century was that if it was observed accurately from different points on Earth, these measurements would allow determining the solar parallax, and from it, the distance between the Earth and the Sun.
In order to reach their destination, the Mexican delegation traveled from Veracruz to La Havana, from La Havana to Philadelphia by boat, from New York to San Francisco by train, and from San Francisco to Yokohama again by boat. The trip began on September 24 and reached their destination on November 9.

The Mexican delegation installed two observatories in the vicinity of the of Yokohama city and successfully made the observation of the transit of Venus across the Sun at both observatories. Of course other countries delegations were sent to Japan to observe this phenomenon.

After concluding his work in Japan, Diaz Covarrubias was invited by astronomers of the French delegation to visit the Paris Observatory, which reached by traveling to the west through Asia and Europe. Being in Paris, in 1875, Diaz Covarrubias published the results of the transit of Venus observations made by the Mexican delegation in Japan. It is noteworthy that the Mexican delegation was the first to do so, for the French, British, Russian and American delegations did it several years later. A few months after his return to Mexico, Diaz Covarrubias published the results of the Mexican mission in the book "Journey of Mexican astronomical commission to Japan to observe the transit of the planet Venus across the Sun on December 8, 1874," which was published in 1876. The entire trip reminds us of Jules Verne's novel, but unlike the characters in "Around the World in 80 Days", which they did traveling to the east; the Mexican delegation did traveling to the west and took them considerable longer time.

The success of the expedition to Japan allowed Diaz Covarrubias to relaunch the idea of reinstalling the astronomical observatory at Chapultepec. At the start of the presidential administration of Porfirio Diaz, with the change of administration in 1876, Vicente Riva Palacio was in charge of the Ministry of Development and was the one who took up the idea and convinced President Porfirio Diaz to continue supporting it. By presidential decree of December 18, 1876, Diaz...
created the National Astronomical Observatory and the 28th of the same month, Angel Anguiano, disciple of Diaz Covarrubias, is appointed Director. By the same time, the new facility construction began and on May 5, 1878 the National Astronomical Observatory in Chapultepec is opened.
Diaz Covarrubias was appointed minister of Mexico before the Republics of Central America residing in Guatemala, position he held from 1878 to 1880. He returns to Mexico to teach at the National School of Engineers and to continue his academic work that included representing Mexico in multiple international scientific conferences. In 1886, he was appointed Consul General of Mexico in Paris, where he died in 1889. In recognition of his work as an astronomer, mathematician, geographer, teacher and researcher, his remains rest in the Rotunda of Illustrious Persons since 1921.

**Tacubaya Observatory (1876-1954)**

The first four directors at the NAO were engineers: Angel Anguiano (1840-1921) from 1876 to 1899; Felipe Valley (? -1910) From 1899 to 1910; Valentin Gama (1868-1942) from 1910 to 1914, and Joaquín Gallo (1882 -1965) from 1914 to 1947.

From 1876-1947 NAO functions were divided in types: the actual astronomical ones, which were mainly directed to the astronomy of position study and dissemination (including observation of asteroids, comets, planets and solar eclipses), and a range of services related to astronomy and earth sciences that through the years were channeled to other institutions such as: geodesy, mapping, geomagnetism, climatology, seismography and hour service.

The following dates are some of the major anniversaries associated with this period.

Angel Anguiano was a Diaz Covarrubias disciple. In 1876 he received the task of directing the NAO, inaugurated in 1878 in the Castle of Chapultepec. The creation of the NAO was due, as already noted, to the good offices of Vicente Riva Palacio (1832-1896) and Diaz Covarrubias. Astronomers convinced Porfirio Diaz (1830-1915) of the importance of the project telling him that the observatory would allow precise mapping for the whole republic, besides attending strictly astronomical aspects.

In 1881, the first National Astronomical Observatory Yearbook is published, a publication continued unabated to date. In 1883, the National Astronomical Observatory is moved to the former Archbishop Palace in Tacubaya.
In 1887, the National Astronomical Observatory receives an invitation from Admiral Mouchez (1821-1892), director of the Paris Observatory, to participate in the international Carta de Cielo project. In this project the Tacubaya Observatory was in charge of covering the strip between the -9 and -17 degrees declinations, approximately 2450 square degrees, i.e. 6% of the sky area. In 1891, the refracting telescope is installed in Tacubaya, and his task was to take the photographic plates of Carte du Ciel, which was also called La Carte du Ciel.

In 1908, new building of the National Astronomical Observatory at Tacubaya is inaugurated. And in 1929, the decree of UNAM is issued, which states that the NAO becomes part of this university.

Guillermo Haro (1913-1988) was director of the National Astronomical Observatory from 1948 to 1968. In 1951 the telescopes from the Tacubaya Observatory relocated in a piece of land next to the Tonantzintla Astrophysical Observatory. This relocation was necessary due to the light pollution of Mexico City. However, when the refracting telescope responsible for the Carte du Ciel project from Tacubaya to Tonantzintla was relocated, it was no longer possible to take second period plates for determining high precision movements.

In 1954 the NAO left its offices in Tacubya to settle in the recently created Ciudad Universitaria. Later on, the building of Tacubaya was demolished and the land was used to house one of UNAM's high schools.

In 1964 after having published the Astrographic Catalogue and the Sky Map of the assigned zone of the Tacubaya Observatory, Mexico fulfilled both commitments made with the Carte du Ciel project.
In 1967 the Institute of Astronomy of the UNAM was created, it includes the NAO and its commitments related to positional astronomy, such as: the development of NAO’s yearbook, that keeps being published, and the attraction of public’s attention towards all kind of astronomical phenomena.