LAS CALAVERAS

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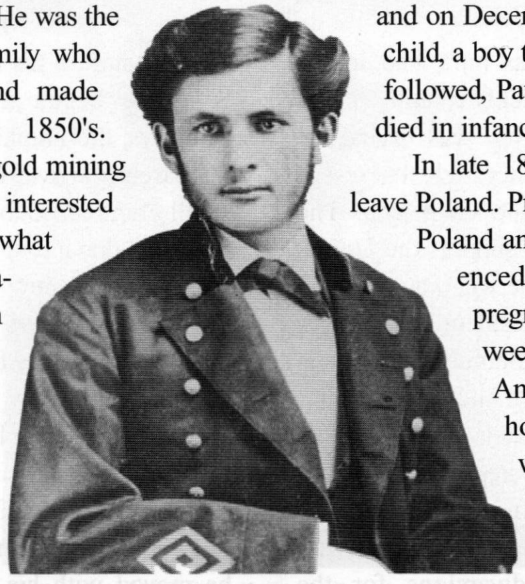
CALAVERAS' NOBEL WINNER

The Story of Albert A. Michelson

by Bonnie Miller

One may not be aware that Calaveras County boasts their own Nobel Laureate. If one were to read every historical marker along their way, of which there are numerous markers in Calaveras County, one may be familiar with the name of Albert Michelson. Unless of course one has attended Michelson Elementary School in Murphys, where such knowledge is compulsory.

Who was Albert Michelson? He was the son of an immigrant pioneer family who traveled to the mother lode and made Murphys their home in the 1850's. Michelson grew up in the small gold mining community of Murphys, became interested in light and optics and pursued what was then a rare advanced education. This advanced education launched a prestigious career in science which led to his winning numerous distinguished awards around the world including the Nobel prize for physics, the first American citizen to do so. From a humble gold rush pioneer to a successful pioneer of advanced principles and applications of science, Michelson saw the world leap forward in his lifetime. This is his story.



Albert Abraham Michelson as a cadet officer at the U S Naval Academy, circa 1871, *from the book* ***The Master of Light.***

From Poland to the United States

Rosalie Przylubska married Samuel Michelson, a young Jewish man from a merchant family in Inowroclaw in Prussian Poland. Together they moved to Strzelno where they opened a shop of their own, and on December 19, 1852 they had their first child, a boy they named Albert. Two girls soon followed, Pauline and Johanna. Baby Johanna died in infancy.

In late 1855 the young family decided to leave Poland. Probably the post-war conditions in Poland and the anti-Semitic attitudes influenced their decision. With Rosalie pregnant they embarked on the three week voyage across the Atlantic to America. In New York they were hosted by relatives of Rosalie's where they were greeted with exciting stories of adventures and fortunes to be had in the California gold fields. Samuel's sister Belle and her husband

Oscar Meyer had already found success in the small mining camp of Murphys in Calaveras County. The Michelsons quickly left New York to join their relatives in California, choosing to travel by the Panama Isthmus route. Under adverse conditions they arrived in San Francisco in late 1855 where they next sought transport to the gold country. The last leg of their journey was finally completed when they disembarked from a crowded stage coach in Murphys in early 1856. Although only four at the time, the impact of this around-the-world journey, especially the Panama adventure, was vividly remembered by Albert for the rest of his life. A detailed account of the trip has been chronicled in his biography, *The Master of Light.*

With the help of Oscar Meyer, Samuel Michelson opened a drygoods store which immediately became profitable in the bustling mining camp. The Michelson family flourished both economically and at home. Born to them in the next few years in Murphys were Julia, Benjamin, Bessie and Miriam. Michelson's store was strategically located near the center of town in the area that is now landscaping immediately adjacent to the historic Murphys Hotel. The family inhabited living quarters attached to the store. The whole structure was lost one Sunday afternoon in 1859 when the town was ravaged by "the great fire". Fortunately no one in the Michelson family was hurt, and in the prosperous surroundings they quickly rebuilt.

Albert Michelson, age ten, with his sister Julie in 1862, *from the book* ***The Master of Light.***

While the Michelson family was living in Murphys news traveled to the Mother Lode that rest of the country was embroiled in the Civil War. The community of Murphys chose to support the Union. When news finally arrived that the war was over, the town celebrated grandly. When President Lincoln was assassinated in 1865, Rosalie and Samuel were devastated, and they chose to honor the man by giving their son his name. Young Albert Michelson adopted the middle name Abraham, which he kept for the rest of his life as though he had been borne of the name.

Murphys was an active and exciting town with many adventures to provide diversions for the Michelson family youngsters. Military guards paraded the main street, shootings were common, the stage came through in a loud flurry every day, and gambling parlors and saloons provided entertainment for the miners. On a quieter scale, the sequoia big trees or the natural bridges provided a pleasant respite for a summer picnic. All of these activities provided fodder to fuel the young imagination.

An Education for the Immigrant

Young Albert's education probably began at home well before he entered formal school. His parents were competent business people who maintained strong family values. Rosalie required that her children learn mathematics, have impeccable manners, and learn the basics of music. It is likely that Albert assimilated many of these life skills prior to arriving in the gold country. Samuel was a successful merchant but apparently Albert did not garner many business skills from his father. As a young man Albert loved to sketch which was a favorite pastime of his while a young boy in Calaveras County. He also played the violin; a skill he took in to adulthood. He was a very inquisitive young man and took an interest in the world around him, a trait that is common to successful scientists. This interest served him well in later years as this drive is what fueled his detailed scientific research.

The start of his formal education is believed to be when he began attending the public school in Murphys, the Franklin School, probably shortly after his parent's arrival in 1856. Albert first attended the small grammar school on the east side of town until it was torn down and replaced in 1860. Until 1864 he attended the new school, which still stands in Murphys today on Jones Street. His teacher, Miss Mary Ann Conway fondly remembered her inquisitive young student. By the time Albert completed the schooling available locally his parents recognized that he deserved to pursue more education than that available in Murphys. His parents urged him to move to San Francisco to continue his education there. In 1864 he moved with his cousins and his aunt and uncle Belle and Oscar Meyer to San Francisco where he

attended Lincoln Grammar School for two years, then transferred to Boy's High School (later Lowell High School) until his graduation from that institution. His principal noted even then that he had a "great aptitude for scientific pursuits" and encouraged Albert by allowing him to set up the school's scientific experiments. In the evenings Albert practiced the violin and learned to box, a sport he enjoyed. While living with his cousins in San Francisco, Albert returned home to Murphys only once in 1867. By then the town was in economic decline and the Michelsons decided to move on following the mining to Virginia City, Nevada shortly thereafter. They had one more son, Charles, born in Nevada in 1869.

When Albert graduated in 1869 from Boy's High School in San Francisco it was evident that he deserved yet more education. Institutions of higher learning were scarce in those post-Civil War days and his parents were most likely unable to afford to support him through additional schooling. The greatest opportunity for a university education lay with the military academies. Albert wanted to attend Annapolis, the Naval academy, as it afforded the best opportunity for an education in science. In 1869 he tried for an appointment.

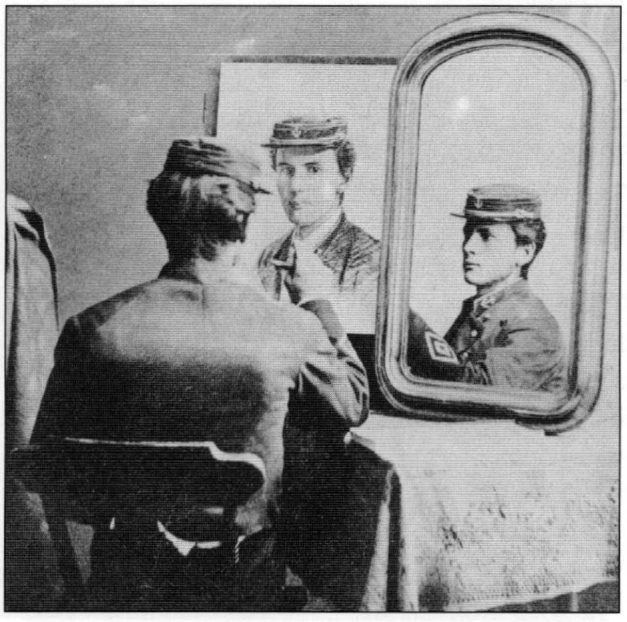
The fifty United States we know today had not yet been formed in 1869. Although California was a state it occupied the "Territory of Nevada." It was the Territory of Nevada that had the right to appoint its candidates to the military academies. In all there were ten "at-large" appointments that were made of candidates from the territories. Albert competed for one of those appointments. Surprisingly he did not get the appointment. He tied with two other young men only one of whom was selected. Despite the set back he was not deterred from his goal. Instead he chose a rather non-traditional route by which to gain the appointment he desired.

Young Albert Michelson, at the age of 17, boarded a train and rode one of the first west-to-east transcontinental railroads to the east coast. His destination was the White House. With a letter of recommendation from his high school principal he was granted an interview with president U S Grant where he pleaded his case as to why he deserved the appointment to Annapolis. Unfortunately the president also turned down his appeal as the academy was filled. Still determined, Albert attempted to gain the appointment directly through the academy by waiting to see if any cancellations or vacancies should come up. After additional interviews and disappointments, when his money was running out, he set out to re-board the train to head back west only to be located by a messenger at the last moment. Apparently his appeal had impressed the right people after all so that on June 28th the president granted a rare "over-quota" appointment of Michelson to attend the Naval academy. In fact the president appointed three extra mid-shipmen to Annapolis that year. Ironically later the candidate who beat Michelson in the tie had dropped out by the Christmas of 1871. President Grant probably never regretted his decision to help Michelson pursue his dream of an advanced education.

A Distinguished Naval Career

Michelson entered the Naval Academy as a midshipman in 1869. He attended the academy until his graduation with the Class of 1873 when he graduated first in his class of Optics, and ninth overall in a class of twenty-nine. After graduation, as an ensign he then served two years at sea in the West Indies. After his tour of duty at sea he returned to the academy, but this time not as a student but as an instructor. For the next four years he served as an instructor of physics and chemistry.

It was during this time as an instructor at Annapolis that Michelson made changes in his personal life as well. Under the settled lifestyle of the college professor



Michelson as a First Classman at the naval academy painting a self portrait, *from the book* ***The Master of Light.***

he found marriage to be desirable. Exposure to young women in a naval academy was very limited yet fortunately his commanding officer unexpectedly provided an opportunity. His commander's wife had a lovely niece who caught Michelson's eye. In 1877 Michelson married Miss Margaret Heminway, to whom he remained married for the next twenty years. Later this marriage proved to be a black spot in Michelson's prestigious life.

Margaret Heminway Michelson, Michelson's first wife, *from the book* ***The Master of Light.***

Annapolis had been good to Michelson as it had provided the means by which he could attain his advanced education. The institution was intended for learning and not research yet by this time Michelson was forming some definitive theories on light and he wished to put his theories to the test. Michelson wished to conduct advanced research yet his primary responsibility was as a teacher. Fortunately he had the backing of some of his commanders and they were very lenient with their young professor and granted him much latitude in his research. In May of 1878 their intuition proved correct and from experiments conducted in the plaza at Annapolis, Michelson awarded the Navy with a definitive calculation for the speed of light. Suddenly the young man, a navy ensign of 27, had dazzled the world of science with his discovery.

At home his life was expanding as his and Margaret's family grew. They had two sons, Albert Heminway born in 1878 named for Margaret's father; Truman, born in 1879 and named for Margaret's uncle; and a daughter, Elsa born in 1881 and named for a character in an opera that moved Michelson. These changes in his family which should have been happy were in fact stressful for Margaret. She was seeing less of her husband as he became more involved in his exciting scientific explorations and she was finding herself increasingly raising the children without him. His successes were double edged in that she thrived on the attentions but she resented that his work kept him so pre-occupied.

By special arrangement Michelson was granted a transfer within the navy in 1879 to the Nautical Almanac Office. He hoped to continue his research there although in reality there were no institutions in the United States that provided the precise scientific environment that he sought. Various grants allowed him to pursue additional post-graduate studies in Europe from 1880 until 1882. He even received a grant through the efforts of Alexander Graham Bell. He and his young family lived for a short time in Paris where he invented the device which later became his most famous: the "interferometer". While in Europe he had access to some of the great scientists of the time who welcomed him in to their circles. Coupled with Margaret's social charm, his own sphere in the science world was expanding. But Margaret's and Michelson's goals were often at odds with each other. Margaret strove for social attentions, and Michelson sought scientific advances. In 1881 he received a special appointment on the faculty of the newly founded Case School of Applied Science in Cleveland, so the Michelson family returned to the United States. This move to Cleveland did not appeal to Margaret. By 1883 Michelson realized that his work had progressed far beyond the Navy, and he formally resigned his commission. Years later the navy recruited him back for further instrument development during World War I.

A Return Home

In the summer of 1886 Michelson traveled with his two sons back to the Mother Lode for a vacation. He wanted to show his boys the home of his boyhood. Of particular import was his desire to show his sons the fascinating big trees. While he had been gone for twenty years much about Murphys had changed. Most significantly the town had experienced two major fires and reconstructions. These changes led to one of the great mistakes, in our local opinion, that he made. While visiting Murphys and strolling down the pretty Main Street, Michelson could not exactly place where his family home had been. He looked at the home at the east corner of the intersection of Church Street and Main Street and

declared that house to most resemble his childhood home. That home has come to be regarded as the home of Albert Michelson. Further research by local historian Judith Marvin in fact revealed that the Michelson family lived in a home located adjacent to their store, which would have been located next to the present hotel, at the corner of Algiers and Main.

The Great Experiments, and the Even Greater Results

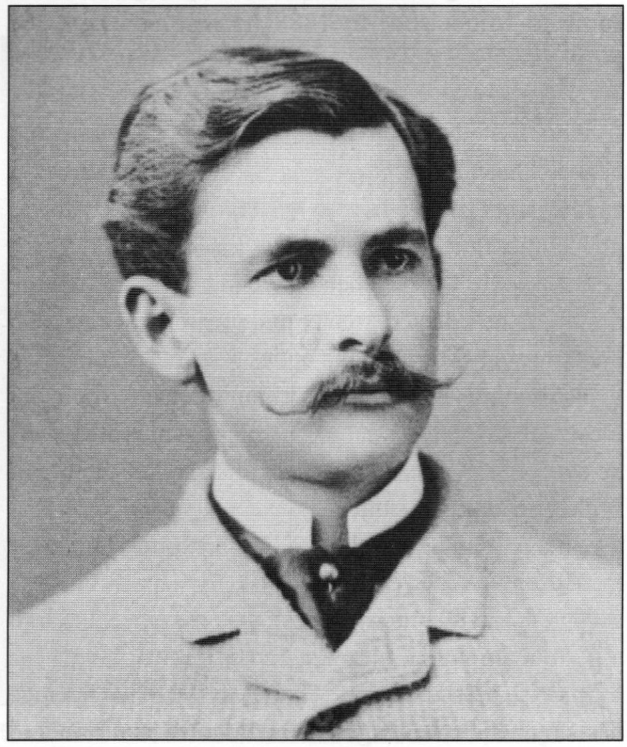
The scientific world of the 1880's had yet no defined method for evaluating the space which the earth occupied. The concept of a round earth traveling in a pattern of a solar system was understood, but no one knew just how *fast* the earth was traveling. It was assumed that the earth occupied an atmosphere of "ether", a rather undefined medium which was assumed to provide the means by which light waves could propagate. Michelson studied light and optics and their behaviors to prove that this substance existed, and to define its properties.

Michelson teamed up with his associate Dr. Edward W. Morley, a chemistry professor, to conduct complex experiments on the behavior of light. The details of these experiments would prove fascinating to a physics student, but we shall try to simplify such a discussion here. It was Michelson's theory that the ether would create a resistance or *interference* with light attempting to travel through it. This was the theory that led to the development of the interferometer, a device intended to interfere with, or split beams of light so that one could study the light's behavior. Michelson intended to split beams of light and evaluate their behavior so that he could study the earth's velocity against the ether. By his own words, he wished to "illustrate light waves and their uses". He wished to solve the equation and determine the speed of the earth's rotation. What he discovered in fact became far more important to science and the world.

In 1887 Michelson and Morley conducted what would later be known as the ether-drift experiments which proved that the ether was… not there! In fact he proved that ether did not even exist. Michelson was sorely disappointed and therefore did not recognize the magnitude of this revelation. He had hoped to solve something with his experiments and instead settled for the satisfaction of having developed the exquisitely accurate interferometer. Scientists regard the ether drift experiment as probably the greatest "null" result experiment in science. Subsequently the experiments set in motion a set of events that led to a chain of scientific breakthroughs.

It was Michelson and Morley's experiment that *disproved* ether that provided the proof of another great physicist's theory. This other theory, refined in 1905 provided an alternative explanation for the propagation of light and has since been proven to be correct. This other theory is known as the "Theory of Relativity" by Albert Einstein. Einstein, 27 years his junior was one of Michelson's proteges in the world of physics.

Michelson and his colleagues built several devices to study light beams. These devices became the basis of optic research and are still in use today. The instruments were not always fondly viewed by Michelson, and often caused him much consternation as he strove to develop the precision that he needed to make the exact measurements he was attempting. One device he referred to as his "she devil". Another, the ruling engine, he regarded as his personal nemesis. These devices, primitive by today's standards, were often plagued by inherent shortcomings which compromised their integrity or exactitude. For example, Michelson and Morley attempted to use several different types of gases to interfere with light waves. The gases were difficult to contain and required precisely controlled temperatures



Albert Michelson, 1887, *from the book* ***The Master of Light.***

which was difficult to maintain. In spite of these obstacles Michelson achieved remarkable precision which often stood unsurpassed for many years. Once when one device was improved upon by another scientist, Michelson set about to best that record yet again.

In 1885 Michelson was made a fellow of the American Academy of Arts and Sciences which began to bring both good and bad attention his way. This was the distinguished academy where appointment was highly coveted by the science community. In later years Michelson used his position in the academy to object to the appointment of another candidate, Thomas Edison. Michelson felt that Edison's work lacked scientific integrity and was motivated by the potential for monetary gain. Eventually his opposition was overturned by the academy and Edison was admitted in 1927, after Michelson completed his term as the academy's president in from 1923 to 1927.

Michelson personally considered that the ether drift experiments were his greatest contribution to science yet the world of science continued to regard him as the young naval officer who had calculated the speed of light. Finally in 1886 Michelson received recognition for his experiments when he received the honorary degree, a doctorate from Western Reserve University. This award may have been assisted by Morley, but it served to remove a curtain and began a series of honorary degrees which came to Michelson. In 1888 he received both the gold and silver Rumford medals.

In 1889 Michelson left Case and was appointed first chair in physics to Clark University in Worcester, Massachusetts. Margaret was happy about the move as it brought them closer to her family in the east. The new contentment was not to last for long.

In the 1890's Michelson's career was advancing rapidly as he pursued greater and greater advances and breakthroughs. In 1890 his optics research was applied to astronomy and while working between the Lick Observatory on the west coast and Harvard University he successfully measured the diameter of a satellite of Jupiter. In another venue, Michelson had advocated the use of a particular wavelength of light as a standard for measurement. Eventually this concept became accepted. In 1893 he was able to use the wavelength of a light beam passed through heated red cadmium gas for precise measurements. This experiment became the basis by which the length of the international standard meter is defined. By the 1960's with the advent of the computer and advanced technical instruments, Michelson's measurements were ratified.

In 1893 Michelson and over a hundred other distinguished professors were offered positions on the faculty of a new technical college to be built on land donated by Marshall Field, the University of Chicago. Michelson had been working in Europe on the meter measurement experiment when he received word of the appointment and was thrilled to join the faculty as first chair of physics as it allowed him to remain in an academic environment and continue his scientific research. Margaret was not as excited about the relocation and resisted by buying a house of her own on the east coast where she could be closer to her family. The following year the family did finally move in to a brick row house in Chicago, identical to the one next door, which Margaret found not to be any more to her liking than living in Cleveland had been. Little did they know that Michelson would remain in Chicago for almost the next forty years.

Michelson the Person

As a member of the University of Chicago faculty Michelson could go to the Quadrangle Club for recreation. He personally preferred tennis and during the colder months of the year he played billiards. Intellectually he was fond of chess and the mechanics of music. He continued to play the violin throughout his life and enjoyed music performances at every opportunity. The dedicated scientist had little time to enjoy music much less sleep. His successes were not without hardship at home. His personal life was intriguingly complicated. While working with Morley on their experiment, Michelson had driven himself beyond his physical limits much to his family's alarm. For two months in 1885 he had to be institutionalized until he regained his strength. Under the care of Dr. Allen Hamilton, a grandson of Alexander Hamilton, Michelson was able to regain control of his faculties. He never forgave his wife for having had him hospitalized. He quietly suffered from recurring nightmares and bouts of depression while publicly suffering multiple humiliations. Less than a year after his hospitalization for mental illness, in the fall of 1886 his laboratory at Case was burned in a suspicious fire. In 1887 his home was burglarized which was insignificant to Michelson but it was devastating to Margaret as

she lost her valued personal treasures that she had collected on their travels. Fortunately most of these items were recovered. Later that same year a housekeeper attempted to blackmail money from Michelson by creating a scandal insinuating seductive behavior on the professor's part. He was cleared of the matter which was sealed with a vote of confidence from his faculty. But these blows to his psyche continued to plague him and could not help but take their toll.

During these years Michelson's career blossomed. He became more and more dedicated to his work as each successful experiment unlocked a door to yet another new dilemma he wished to solve. His work was bringing him fame both within his university circles and internationally. Concurrently his home life deteriorated as his goals continued to conflict with Margaret's needs. Finally in 1898 he sought a divorce from Margaret, an action which cast a stigma on the brilliant professor.

In 1895 a young woman had came to Chicago University as a student of literature against her parent's wishes. She was Edna Stanton, born in 1871 in Bristol, England. She was an intelligent person who enjoyed the lively conversations of her intellectual colleagues but was distressed to see the men she admired throw themselves at seemingly silly women. While attending a quiet university party in 1898 she met the famous science professor who was dealing with the concurrent reputation as the professor seeking a divorce. They left the party together and became fast friends, both admiring each other's intellect. While Michelson's and Edna's friendship grew, he was dealing with the divorce, had been elected in 1899 as the President of the American Physical Society, and was delivering eight lectures at Harvard which were to become the basis of his first book. When Michelson's divorce was finalized, after a short engagement he and Edna were quietly married over the Christmas holidays in her parent's home on December 23, 1899.

Edna revered Michelson and he adored her. In the next few years she had their three children, three girls whom Michelson cherished. In 1902 their first daughter Madeline was born and Michelson composed a lullaby for her on the violin. In 1904 their next daughter Beatrice was born and in 1906 Dorothy joined the family. The two older girls couldn't pronounce the complicated name of their younger sister, so they said "Dody" which became her name thereafter. The marriage and family thrived and it was these early years of the marriage that Edna recalled as her happiest. The marriage to Edna appeared to signify a turning point in Michelson's life. He continued to seek scientific advances and he was a dedicated if not exemplary professor. But he no longer allowed the work to call him away from his family life as he had earlier in his career. Despite his rigorous academic work he was a devoted father to his children. He loved to spend his summers vacationing with his family and pursuing his other interests such as sailing, fishing, tennis and painting.

Michelson's life continued to progress happily and his career advanced to one of a solid respected university professor. He continued to perform cutting edge experiments, often with special funding or grants provided by Andrew Carnegie, whom had taken a particular interest in the scientist. The relationship between Michelson and Carnegie proved useful in later years.

In this happy and somewhat sedate life with Edna and his new young family Michelson finally achieved the high international acclaim that he deserved. He continued to conduct exciting research and perform his academic duties. In1907 he received the Copley medal from the Royal Academy. Later that year rumors began to circulate that he was being considered for the Nobel prize.

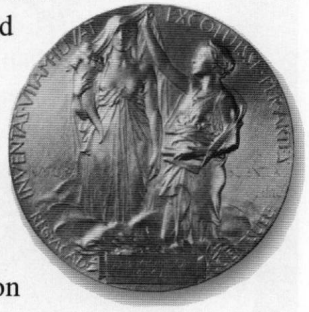
Edna Stanton Michelson, Michelson's second wife pictured with the family pet dog Domino, *from the book* ***The Master of Light.***

The Nobel Medal

The Nobel Foundation had only been established twelve years earlier in 1895 and was still somewhat young. The Swedish Royal Academy of Sciences had only awarded their first prize for science in 1901. The motto of the academy loosely translates to mean *"And they who bettered life on earth by new found mastery."* Michelson certainly fit this description.

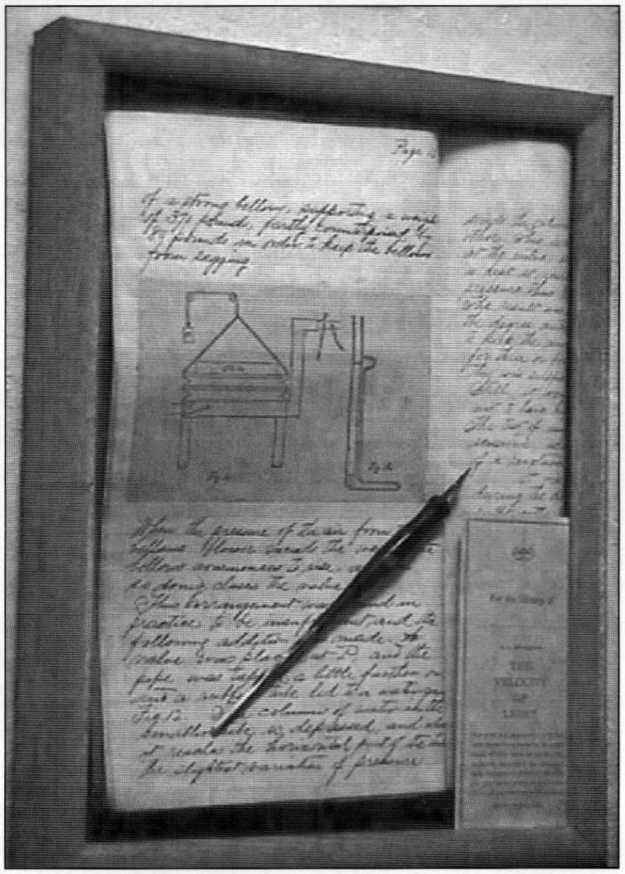
In December of 1907, under secrecy, Michelson was summoned to Sweden. He traveled alone and left Edna and the young girls at home. On December 10 he received the award publicly "for his optical precision instruments and the research which he has carried out with their help in the fields of precision metrology and spectroscopy." For the next two days he was feted by the Swedish science community. Much of his celebration was overshadowed by the presence of the British author Rudyard Kipling who received the Nobel prize for literature that same year. On December 12 Michelson addressed the Academy and delivered his speech "Recent Advances in Spectroscopy", a speech which in later years he felt had been one of his best. The year before, U. S. President Theodore Roosevelt had received the Nobel prize for peace. Nevertheless, in December of 1907 Michelson returned home a hero as the first American scientist to win the Nobel prize.

While at the Nobel ceremonies he was reunited with his son Albert, then 29, whom he had not seen in ten years since before his separation from Margaret. The younger Michelson had graduated from Harvard and was serving as the American consular in Belgium. He had learned of his father's award in Sweden and traveled to that country to congratulate him personally. Upon returning home, Edna was so happy to learn of the reunion that she encouraged Michelson to reconcile with his other children as well. Michelson's second son, Truman and he reunited soon thereafter. Truman had also graduated from Harvard and was pursuing a career in anthropology. Margaret had since remarried, but Michelson never had the pleasure of seeing his daughter Elsa again.



For the next few years Michelson enjoyed the prestige of the distinguished professor. He continued his work with the University of Chicago and continued research which led to more scientific advances. In 1911 exchanged professorships and served at the University of Göttingen in Germany. In 1914 he successfully measured the rigidity, and conversely the elasticity, of the earth.

World War I called Michelson back to the navy. In 1918 and 1919, he volunteered at the age of 65 and served as a Lieutenant Commander in Naval Research in Washington where he conducted research to aid the war effort. It was during this time that he perfected the optics binoculars that he invented for spotting submarines in poor visibility. Michelson was relieved from active duty in the Coast Defense Reserve on 13 May 1919 by Acting Secretary of the Navy, Franklin Roosevelt. He left the



A reproduction of the lab book that Michelson kept when conducting the famous ether drift experiments, on display at the Michelson Elementary School in Murphys. *Photo courtesy of the staff of the Michelson Elementary School.*

rank of commander and received commendation from the chief of the Bureau of Ordnance, Rear Admiral Ralph Earle and returned to Chicago.

By 1920 Michelson was actively pursuing the application of his knowledge of optics to astronomic use. He began to conduct experiments at Lookout Mountain in the San Gabriel Mountains in Southern California to use light to measure distance. He conducted similar experiments at the Lick Observatory on Mount Hamilton in the Bay Area of Northern California.

He worked at the fledgling Wilson Observatory in Southern California and in 1922 successfully measured the diameter of the star Betelgeuse. For the next few years he traveled between Chicago and the west coast to work on experiments there. In 1927 he published the small textbook *Studies in Optics* which became a classic guide for physics and optics in university science classrooms around the world. The book is still widely used today and is regarded as the authority of the basics of optics. Later that year the Optical Society of America dedicated their annual meeting to the fiftieth anniversary of his scientific career. Fifty years had passed since the young naval officer had calculated the speed at the naval academy, and he was still performing complex experiments with light and teaching full time at the University of Chicago.

By 1929 Michelson's health was beginning to trouble him. With regret he finally decided to retire from his exciting career. He left his dear home in Chicago and retired from active employment yet sought another dream: working in an astral observatory. The observatory was Mount Wilson, built with funding provided by Rockefeller and Carnegie 6,000 feet above Los Angeles. At first Edna was reluctant to leave the house in Chicago that she had come to love, but Michelson assured her that California had its own special beauty that she would appreciate. They moved to Pasadena where they often entertained scientists who came to work at the observatory or who just wanted to visit the professor. One such visitor was Albert Einstein.

Einstein recognized that Michelson's work paved the way for his own Theory of Relativity, just as his theory ultimately proved to open the door for the subsequent Theory of Probability. Both scientists tried to remain open minded to new breakthroughs even if it rendered their own work obsolete. Michelson had always advocated greater precision at each new venture. He strove to not be offended when another scientist was able to improve upon his own work. Rather, he regarded it as a challenge to do even better. In his own words, he encouraged others to always work "toward the next decimal place."

Michelson enjoyed his retirement in sunny Southern California and his work with the observatory and continued to make the most of his life. When working at the observatory at Mt Wilson, he often played billiards in the evenings while waiting for the sun to go down until he could observe the stars. In 1930-31 Michelson worked on conducting studies on the velocity of light in a vacuum tube. He offered instruction and guidance almost daily to the experiments as his health allowed. On the morning of May 9, he quietly passed away at his home in Pasadena.

Legacy

Calaveras County never forgot the young man who lived here for only a very short time during the gold rush. Since Michelson left Murphys in 1864, school continued to be taught in the little one room school house that he had witnessed the construction of. The town had far outgrown the facilities and in the early 1970's the new Vallecito School District that encompasses the Murphys area began construction on a new elementary school. A local contest was held to name the new school. The final names being considered were

Portrait of Albert Michelson, circa 1915. *Photo courtesy of the staff of the Michelson Elementary School.*

Sequoia Elementary, Ponderosa Elementary, Murphys Elementary, or Michelson Elementary. Local historian Kenneth Castro had submitted the suggestion of using Michelson's name with a well-researched biography and list of accomplishments to justify his nomination. The selection committee was impressed with the suggestion and named the new school after Albert Michelson when it opened in 1973. The school has since been an exemplary showcase of elementary education that would make Michelson proud. In 1993 it was recognized in a special statewide ceremony when it received the California Distinguished School Award.

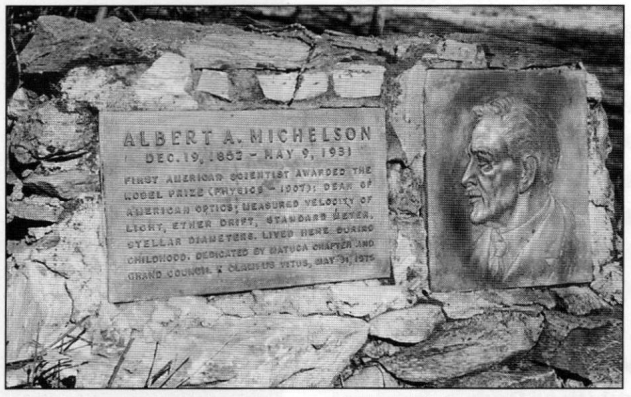
Prior to Michelson's passing, at a dinner given at the California Institute of Technology, Albert Einstein paid homage to his mentor. At the celebration of Michelson's 100th birthday, Einstein repeated the words he said of his friend:

"My honored Dr. Michelson, it was you who led the physicists into new paths, and through your marvelous experimental work paved the way for the development of the theory of relativity."

Ultimately Michelson is credited with inventing or assisting in the invention of the interferometer, the ruling engine, the harmonic analyzer, and the echelon spectroscope as well as perfecting the optical glass used in periscopes, telescopes, gunsights, and binoculars. In particular during WWI he developed binoculars used for the detection of submarines in poor light or at night. Additionally he either measured or assisted in the measurement of the speed of light, the length of the standard meter, the rigidity of the earth, the diameter of a satellite of Jupiter, and the diameter of the star Betelgeuse. In all Michelson developed greater than twenty designs for the interferometer between 1880 and 1887. These inventions provided the basis of his Lowell Lectures that he delivered at Harvard in 1899, and were the substance of his first book published shortly thereafter. Later with the advent of lasers, all of his theories on light and optics were proven to be correct.

The naval academy never forgot their gifted midshipman who came to them by untraditional means. They named their new science building for him, the Michelson Hall of Science. In the plaza fronting the hall, brass markers have been set in the pavement indicating the line of sight used by Michelson for his optical experiments performed while an ensign and instructor in 1877 and 1888. These were the experiments that led to measuring the speed of light. In March of 1985, almost 100 years later, the naval publication *Shipmate* carried a profile on Michelson. Every year a distinguished scientist is invited to come to Annapolis to present the "Michelson Lecture." The Naval Weapons Center at China Lake California has a laboratory which was dedicated to Michelson in 1948. China Lake also houses the Michelson Museum where his research papers are archived.

Much of Michelson's astronomy and observatory work benefitted the space institution, a concept which he could hardly have envisioned when he passed away in 1931. In 1967 the lunar Orbiter V spacecraft traveled around the earth's moon and photographed its dark side, the back side not visible to us on earth. From a distance of 5008 kilometers above the surface of the moon, a photo was taken by Orbiter V of the lunar surface near the feature known as the Hertzspring Basin. The photograph artistically captured a large lunar crater 130 km diameter by 3.5 km deep (77 by 2 miles) at 6°N121°W which was named for Michelson. This interesting crater was formed more that four billion years ago from the impact of a comet or asteroid. Since then many smaller craters have been formed from subsequent impacts within the basin of the main crater. A copy of this photo was presented to the Michelson Elementary School from the Ames Research Center of NASA on 7 April 1976.



Bronze plaque and monument commemorating the house where the Michelson family lived while in Murphys from 1856 - 1867, mistakenly erected in front of the house at the corner of Main Street and Church Street in Murphys.
Photo by Bonnie Miller, February 2003.

In 1987 a centennial celebration was held in Cleveland, Ohio honoring the 100 year anniversary of the Michelson-Morley ether drift experiments.

Michelson has been honored in many ways in recognition of his accomplishments. In addition to the Nobel prize he left a legacy across the globe. Poland honors him as a

Polish son who won the Nobel. Two countries claim Michelson as their hero. Today there is a plaque commemorating his birthplace in Strzelno, Poland. Since he was born in Poland, that country recognizes him as a notable Polish scientist, and the United States claims him as the first US citizen to receive a Nobel prize in science. In his lifetime he received ten honorary science and law degrees from American and foreign universities. In World War II the Navy further named a ship for him, their Liberty Ship No. 2254 carried his name. The Michelson ship was a surveying ship, ID No. 08487, which actively surveyed in the oceans until removed from service on 15 April 1975. His name has even gone to the moon. Perhaps the greatest legacy to which Calaveras County residents are most familiar are the house where his family was believed to have lived in Murphys, and the elementary school which was named for him.

Michelson wasn't the only success in his family that came from the humble roots of the immigrant. He came from a family of accomplished merchants. They valued education, integrity and success. To that end many of Michelson's siblings as well as his own children found successes of their own. Two of his sisters, Pauline and Julie became teachers. His sister Bessie married the distinguished newspaperman Arthur McEwen and became involved in his business. His other sister Miriam was a very successful popular novelist. His brother Charlie was also successful in literature and became the publicity director for the democratic party and wrote speeches for Franklin D. Roosevelt. Charlie went on to write the book *The Ghost Talks*, an inside account of the workings of the democratic party of the day. Michelson's son, Albert Jr, served as an international consul. His second son, Truman, received a PhD from Harvard and wrote books on linguistics. And his daughter Dorothy wrote his own biography, *The Master of Light*.

In addition to his scientific achievements, Michelson was a complex man. By the time he had received the Nobel prize he was the father of six children by two marriages, had invented numerous scientific devices, and been hospitalized for a near nervous breakdown. Throughout his life Michelson always fondly recalled his early life in the gold country. He was particularly attracted to the big trees. He was a musician, a sportsman, and he appreciated the out-of-doors, and he doted on his later children. The father Dody knew did all of the above. But did his first family enjoy such attentions from him? His second family never heard him speak of his other wife or children. Several gaps in his personal life prompted research by his youngest daughter Dody, Dorothy Michelson Livingston, which led to his biography published in 1973 by the University of Chicago Press. Many of Michelson's biographers have attempted to draw a correlation between his roots in the gold rush and his successful career in science. We can only speculate at what fascinated and inspired the young boy to study light. Perhaps his curiosity was sparked or he gained inspiration from the glitter in the gold or the light that filtered through the big trees that he so admired. We do know that he held his boyhood home in high esteem for the remainder of his life, and that he regretted having only returned once to revisit the community of Murphys. Perhaps his greatest accomplishment is the he exemplifies the true spirit of discovery and western expansion.

And what is the speed of light? It is 186,355±31 miles per second.

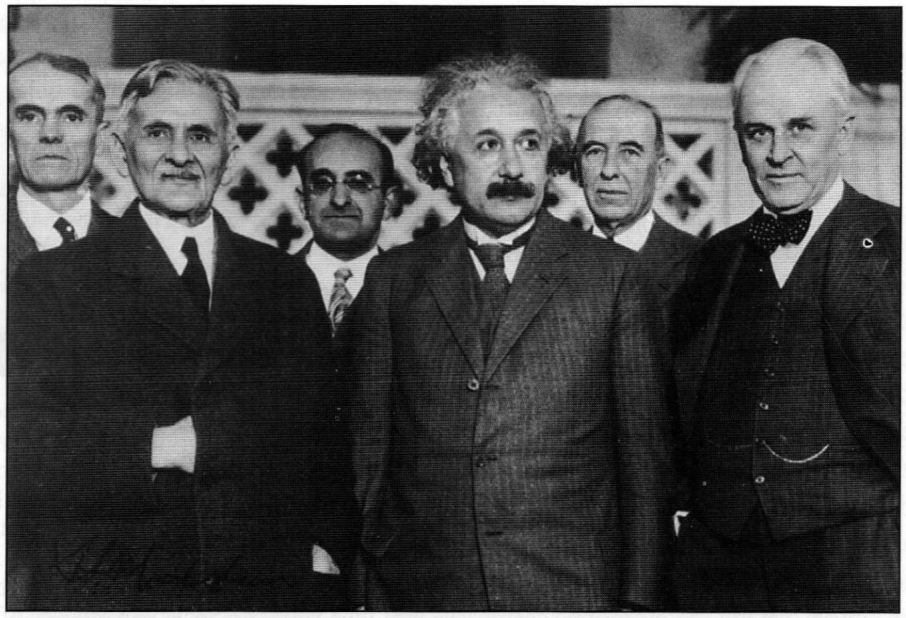


Photo taken by William Kellog in Pasadena in 1931, which shows what esteemed company Michelson kept. Left to right, Walter Adams, Michelson, Walther Meyer, Albert Einstein, Max Farrand, and Andrews Millikan. *Photo courtesy of the American Institute of Physics.*

Calaveras County Historical Society

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The Calaveras County Historical Society is a non-profit corporation. It meets on the fourth Thursday of each month in various communities throughout the County. Locations and scheduled programs are announced in advance. Some meetings include a dinner program, and visitors are always welcome.

The Society operates the Calaveras County Museum which is open daily from 10:00 to 4:00 in the historic County courthouse located at 30 Main Street in San Andreas.

The Society's office is located in historic San Andreas, the Calaveras County seat. Visitors are always welcome to stop by the office for assistance with research, and are encouraged to visit the museum while in the area. The office is open Monday through Friday from 8:30 to 4:00, and the telephone number is (209) 754-1058, or contact us at: CCHS@goldrush.com.

Museum Donations

The Calaveras County Historical Society wishes to thank the following persons who recently made donations to the Calaveras County Museum:

December 2002

Don Cuneo, Calaveritas, CA
Two photos of Moonlight Flat

January 2003

Mary Jane Crockett, Oakley, CA
Judge Howard Blewett's flintlock four-barrel shotgun and photos

Shirley Huberty, San Andreas, CA
"My Life and Boyhood Days in West Point" by Arthur Wilson

Roz Bray, Bear Valley, CA
Picture of Camp Tamarack

Wally Motloch, Mountain Ranch, CA
Photos and CD with photos of Mt. Ranch

Amy Jordan, Greenbrae, CA
Two framed photos, one hard mount

February 2003

Bill Fuller, San Andreas, CA
Two hard mount photos, two post cards, mining certificate and several newspaper articles

Don Cuneo, Calaveritas , CA
Misc. photos, two Carson Trading Store receipts from 1919 and an article on Monte Wolfe

Ken & Lorraine Foley, San Andreas, CA
Hercules Boiler Heater c. 1890 and bathtub

Christine McCombie Anderson, Walnut Creek, CA
Letter and photos of Mr. Weldon and Fischer School

NEW LIFE FOR AN OLD MARKER

Our thanks go to Bill Norris of Mountain Ranch who took on the restoration of the historical monument on Mountain Ranch Road. After forty years of decorating the roadside, the monument was showing severe signs of weathering. Bill has spruced up the monument and replaced the picturesque wagon wheel that had begun to self-destruct with a more weather resistant model, yet has kept its historic charm. The next time you drive by take a good look at the revitalized monument.

The monument commemorates the famous last stage robbery in the county that occurred at that location. The placement of these commemorative markers is a cornerstone of the Historical Society's stated purpose. For more information about the original monument, see *Las Calaveras* April 1964. The monument was first erected in 1963 and dedicated by the Calaveras County Historical Society in January of 1963. Thank you Bill for restoring this beautiful monument for all to enjoy!