THE REALM OF SCIENCE

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THE American Association for the Advancement of Science held its 64th annual meeting in Cleveland during the week beginning Monday, December 30, 1912.

It took place in the buildings of the Western Reserve University and the Case School of Applied Science, these two institutions being so close together that one needs to be told of the fact that they are two and independent, and not one and the same. Their courses of study, however, do not overlap.

After the formality of calling this 64th meeting to order on Monday morning at 10 o'clock, very few sections began work on that day. The principal one among these was Section B, Physics, which convened in the physical laboratory of the Case School. This is a large room, probably one hundred feet square, the seats being arranged in tiers. The lecture table is fully sixty feet long. There is, of course, every convenience that a modern lecture room demands, and a corresponding wealth of apparatus in adjoining rooms. The instrument which the professor, D. C Miller, prized most, is a Riefler clock, which is kept in a vacuum and in a constant temperature and wound by electricity. Its time-keeping qualities were said to be marvelous.

Six of the seven papers were read that morning and thirteen in the afternoon until five o'clock. They were all very technical, and for many the blackboard was covered with the most advanced mathematical symbols.

At eight o'clock in the evening there was a general session in the ball room of the new Hotel Statler, at which Dr. Charles E. Bessey of the University of Nebraska, the retiring President of the Association, delivered his address on "Some of the Next

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Steps in Botanical Science,'' which has since appeared in full in Science for January 3rd.

The next day, Tuesday morning at 10:30, the Astronomical and Astrophysical Society began its 15th annual meeting in the main building of the Case School. The interior of this building looked antiquated, and the electric wiring was rather inelegant, as it was encased in pipes strung visibly on the ceiling, one of them being so slovenly fastened that it threatened every moment to fall. The windows could be darkened by black curtains, and the lantern used was a mate to the Bausch and Lomb convertible balopticon in the Creighton physical lecture room.

The writer's paper, ''Astronomy in the Civil Court,'' happened to be second on the list. It dealt with the shadow with which all Omahans are sufficiently acquainted. It was introduced by the president, Professor Edward C. Pickering, of Harvard College Observatory, with the remark that it was a very practical application of astronomy and a solid refutation of the charge that the higher sciences are often regarded as purely speculative and of ''no earthly use.'' Several astronomers on that and the succeeding days pronounced the paper a most interesting one. The two best Cleveland dailies gave it a flattering notice and the secretary of the Royal Astronomical Society of Canada asked for a copy of it in order to publish it, together with the photographs, in an early number of his journal.

Seven papers were read and discussed that morning from 10:30 to 12:30. At 2 p. m. there was a joint meeting in the physical laboratory of Section A, Astronomy and Mathematics, of Section B, Physics, of the American Mathematical Society, and of the Astronomical and Astrophysical Society. As a matter of fact nearly all the members of the American Association for the Advancement of Science are also members of affiliated societies, which hold their meetings at the same time, so that practically most of the sections of the Association are merely nominal, Sections A and B especially holding their official meeting only at this joint session.

The object of the joint meeting was to enable the retiring vice-presidents to give their addresses. The first of these was on ''The Spectroscopic Determination of Stellar Velocities; Con-

sidered Practically,'' by E. B. Frost, director of the Yerkes Observatory. As he, however, was in Europe at the time, his paper was read by J. S. Parkhurst, one of his assistants.

The second address was on ''Unitary Theories in Physics,'' by R. A. Millikan, of Chicago, who read for over forty-five minutes at a racing rate. The third paper on ''Henry Poincare as a Mathematical Physicist,'' by A. G. Webster, was very good in the first or biographical part, but when he began to pick out some choice bits of mathematics from Poincare's works and fill the blackboard with symbols, the attention of his audience began to flag. When his successor, E. J. Wilczynski, began to illustrate ''Some General Aspects of Modern Geometry'' in a similar way, the lateness of the hour made me forego the rest of this paper, and all of the next one on ''Cosmical Magnetic Fields,'' by L. A. Bauer. I was sorry to miss the last one, as Bauer is one of the greatest authorities on terrestrial magnetism. He has sailed across the oceans in all directions in an absolutely non-magnetic ship, the only iron and steel in it being the magnets and the thin lining of the cylinder of the gasoline engine which propels it in a calm. He has already corrected many important errors in regard to the mariner's compass in different parts of the world.

On the following day, Wednesday, the Astronomical and Astrophysical Society resumed its session, no regard being paid to the fact that it was New Year's Day. On Thursday all the papers were disposed of by one o'clock, when the society adjourned for a year.

In all, thirty-one papers were read and most of them discussed. The majority dealt with highly technical matters which showed the wonderful development of astronomical science. Only a few may interest the non-professional reader.

W. Gaertner, the maker of our position micrometer, showed photographs of a new type of printing chronograph, in which the hour, minute, second and hundredth of a second are printed in ordinary numbers the moment the key is depressed. In the usual form of machine in the Creighton Observatory, the distance of the key mark from a clock mark must be measured on a scale. In the discussion the astronomers were divided upon the merits of the new invention.

R. M. Stewart, of Ottawa, Canada, explained a method of synchronizing secondary master clocks, which in turn operated several hundreds of electric dials throughout the city.

W. S. Eichelberger spoke of the minute distortions of photographic films, and of the difference of temperature in various parts of a telescope, and of the errors they introduced into refined measurement. H. C. Wilson, the editor of Popular Astronomy, gave a graphic chart visualizing the sun's way through space. W. T. Humphreys, of the Weather Bureau, exhibited a chart which showed the variation in the sun's heat received by the earth during the last thirty years. They were three remarkable minima in two of which the heat received dropped to 90% of its average amount, and in one case that of the year just passed, it fell to as low as 80%. Each of the three cases was preceded by the outburst of an explosive volcano, that is, of Krakatoa, Mount Pelee, and one in Alaska. Humphreys called attention to the fine volcanic dust which these eruptions had spread in the upper strata of our atmosphere, the so-called isothermal layer, in which the temperature is constant and there is no circulation. This dust remains suspended a long time and intercepts the sun's rays, thus preventing the heat from reaching the earth. He said that in former geologic ages there must have been such outbursts of explosive volcanoes whose dust could intercept enough of the sun's heat to cause the origin of ice ages. These ice ages, he said, were established facts and they occurred all over the earth at the same time. A reduction of about 10 degrees in the earth's mean temperature would be enough to cause an ice age. Several astronomers agreed with his statement that the sky had not been very transparent for many months past.

The astronomers had finished all their papers in the morning session in order to be able to visit the works of Warner and Swasey in the afternoon. Owing to a fortunate oversight on my part I did not join the party at the time and place of starting. The consequence was that instead of wasting about two hours in a motor car factory, to which the party was taken first, I was one of a small company of six persons whom W. R. Warner and A. Swasey personally conducted through their works. This firm,

as may be known, has built the 26-inch Washington, the 30-inch Lick and the 40-inch Yerkes telescopes, all except their lenses, but including the domes. As such large telescopes are so seldom called for that it would not pay to erect machinery and shops for their exclusive construction, Warner and Swasey occupy themselves with the production of lathes, especially the universal hollow-hexagon turret lathes. They make astronomical instruments to order and they had a sample of almost every sort set up for inspection. Their most valuable machine is a dividing engine, which, when properly set, will automatically divide a circle into degrees and fractions so accurately that a high-powered microscope will rarely discover an error. The circle in the Creighton transit was graduated on a similar machine by another firm (Fauth & Company) and is read by two compound microscopes. It can give its position on the earth's surface to within ten feet.

The Case School of Applied Science has a small observatory which I visited on Wednesday in company with G. D. Sweezey, of Lincoln, and a few others, under the guidance of its director, D. T. Wilson. The transit is a 3-inch exactly like ours in the Creighton observatory, except that it has no finely divided circle read by micrometer microscopes. To make up for this deficit there is a fine zenith telescope of the usual style. There is no equatorial, probably because the Western Reserve University has one of 10½ inches aperture, which, however, was closed when I visited it. In place of it there is a 6-inch almucantar. This is a telescope lying horizontally on a massive steel raft, which floats on 300 pounds of mercury. A mirror is firmly clamped outside of the objective, and as the raft is swung around it enables the astronomer to observe stars at absolutely the same elevation in the sky. The marvelous accuracy of measurement predicted for this type of instrument has not been verified in practice, and floatation on mercury has proved itself inferior to a spirit level. Georgetown College Observatory had the same experience and after a year's test replaced its floating zenith telescope by one of the ordinary type, furnished, however, with four sensitive levels.

The Jesuit Colleges were represented at the Association

meeting by eight delegates, nearly all being members. They were Fathers Cusick and Rafferty, from Boston; Coyle, from Worcester; Martin, from Georgetown; Shannon, from St. Louis; Odenbach and Gerst, from Cleveland, and myself. They attended various sections.

I must not omit to mention the science department of St. Ignatius College, Cleveland, whose president, Rev. John B. Furay, comes from a well-known pioneer Omaha family. The chief scientific ornaments of this college are its meteorological and seismological departments. Besides the valuable old curio, Father Secchi's original meteorograph, which earned for him in 1870 the Cross of the Legion of Honor from the hands of Napoleon III personally, there is every type of a modern self-recording meteorological instrument. The director, Father Frederic Odenbach, is quite an authority in his science. He is also the founder of the Jesuit Seismological Service, which has earthquake recording machines of the same make in many colleges. Creighton University did not enter the union and set up a seismograph for the reason that such a machine requires almost the continuous attention of one man. Father Odenbach has at least four different seismographs, which he operates most successfully along with his meterological appliances, and in addition spends some hours every day in the class room. He is without assistants and is therefore so tied down to his observations that he has not been able for many years past to leave the city for a single day.

The scientific lecture by Professor Patty on January 18th in the University auditorium was listened to by a large and attentive audience, composed mostly of the students and professors of the various colleges. While the subject matter itself, wireless telegraphy, radium and liquid air, was interesting in its very nature, the lecturer had a happy way of his own of presenting things. He urged the students to make every use of the advantages they enjoyed and become leaders in their respective spheres.

On Thursday evening, January 16th, Professor Rigge ad-

dressed the Off-Night Club on some interesting topics in astronomy.

In a late number of the Astronomische Nachrichten there is an interesting, although technical, report by F. W. Ristenpart, director of the observatory of Santiago, Chile, South America, of the simultaneous observations at various stations of the eclipse of a star by Ganymede, one of Jupiter's satellites, on August 13, 1911. As this was an extremely rare event, the director had advertised it extensively, so that amateur as well as professional astronomers might observe it and report to him.

Thirty-two persons observed the eclipse in various parts of the country. In commenting upon their work Ristenpart mentions two Jesuits, one of whom he praises as "an experienced connoisseur and lover of all science."

The object of the investigation was to determine the size and shape of Ganymede from the difference of the observed times and the duration of the eclipse as noted at different stations. Chile was admirably adapted for such a determination, since its great length of 37 degrees of latitude, or about 2,500 miles from north to south, and its narrow width, which seldom exceeds a hundred miles, made it practically a long and thick base line.

As many of the observers possessed only small telescopes, and as the weather was not favorable at the extreme stations, Punta Arenas and Arequipa, the latter, however, being just across the border of Chile, in Peru, the net results are not fully satisfactory to the author of the article in question. He discusses them, however, with great ability, and obtains numerical dimensions and a shape of the little moon of Jupiter, which differ somewhat from previous measures obtained by different methods.

After reading this article the writer of these notes is consoled for the cloud that hid Jupiter and his satellites from him at the critical moment, to read that the eclipse of the star was not visible north of Peru. The close conjunction of the tiny moon with the star would, however, have been a very pleasing sight.