erty of bodies allied to that of atomic weight, atomic calorific capacity, etc. As it depends entirely upon the nature of the atoms, the experimenter sought a relation between it and the atomic weights of different bodies, and plots a curve which is quite regular, having somewhat the form of a hyperbola. This curve may be modified by varying the conditions of the experiment, which may be done in three different ways. First, by modifying the character of the X-ray tube; second, by changing the thickness of the standard, which causes, for the different bodies, a variation corresponding to their mass, and in consequence a more or less complete selection of the rays; third, by placing screens of different character in the path of the rays. A series of curves is thus obtained, varying with each experiment. By interposing various screens in the path of the rays, those of greater penetrative power may be sifted out, and it appears that these rays show nearly a direct proportionality between the specific opacity and atomic weight.

EXPECTED RETURN OF ENCKE'S COMET.

BY M. PROCTOR.

Among the periodic comets due in 1901 is Encke's comet, which is expected to return to perihelion about the middle of September. Its last return to perihelion took place on May 24, 1898, the same day on which it also occurred at the first predicted return in 1822. The prediction was made by Johann Franz Encke (after whom the comet has been named), and he detected the periodicity of the comet in 1819.

The comet had been frequently observed during the preceding fifty years, and as soon as the elements of its orbit had been computed and compared with the elements of the orbits of comets which had previously appeared, it was found to be the same comet which had been observed in 1786, 1795 and 1805. Having thus identified the comet at four different returns to perihelion, Encke was enabled to ascertain the period of its revolution with great precision, the result being 3½ years, the comet having the shortest known time of revolution and being the first of the short-period comets.

Encke predicted its return for 1822, making due allowance for planetary perturbations, and on account of its position in the heavens, he announced that the comet would only be visible in the southern heavens. The return of the comet was therefore looked for by astronomers living in that part of the world, and during the month of June was sighted by Rumker at Parramatta, in New South Wales. The next return was predicted to take place in 1825, and on the 13th of July—true to its appointed time—the comet was observed by Valz at Nismes.

The next return took place in 1828, when it was first seen by Struve, at Dorpat, in Russia, on the 13th of October of that year, and remained under observation at the European observatories until December 25. On November 7, 1828, Prof. Struve made a series of observations of the comet, and he noticed a star of the eleventh magnitude so near the center of brightness in the comet that he mistook it at first for the nucleus. The brightness of the star was not in the least perceptible degree diminished by the mass of cometary matter through which its light had passed. By November 30 the comet had greatly increased in brightness, and this must be ascribed to the contraction and consequent condensation of the nebulous matter of which it is composed, as it receded from the sun.

In 1832 the comet again returned to its perihelion, but being unfavorably situated for observation, it was only seen by Harding, at Göttingen, on the 21st of August. However, it was observed by Henderson, at the Cape of Good Hope, during the entire month of June, and was also seen at Buenos Ayres. In 1835 it was observed from July 22 till August 6, and in 1838 it was seen at Breslau on the 14th of August as a very faint, ill-defined object. It subsequently increased in brilliancy and continued visible until the middle of December.

In combining all the observations which had been made from 1786 to 1838 inclusive, Encke found that the period of revolution of the comet was regularly diminishing by about 2½ hours at each return to perihelion. This effect he attributed to the retarding action of a resisting medium in space. This theory seemed to be confirmed by observations made at the return of the comet in 1842, 1848, 1852, 1855, 1858, 1862 and up to 1868; but at its return in 1868 the acceleration had fallen to one-half its customary and, until then, constant value. The change has proved permanent, and accumulated facts bid fair to banish the theory of a "resisting medium" out of existence.

The comet has been seen at every return to perihelion lately, the dates of its visits being 1895, 1898, and it is now looked for in 1901. It has been described as irregular in form and "lumpy" in appearance, seldom showing a well-defined nucleus. Under very favorable circumstances it can be seen with the unaided eye, but is usually visible only in the telescope. It does not exhibit much in the way of jets and envelopes, and the train, when visible, is but a degree or two in length. As the comet approaches the sun, a peculiar contraction takes place in its volume, while it resumes its original dimensions when receding from the sun. For instance, at a distance of 130,000,000 miles from the sun, it has a diameter of nearly 300,000 miles, but when it is near perihelion (at a distance from the sun of only 33,000,000 miles), its diameter shrinks to 12,000 or 14,000 miles, the volume then being less than one-ten-thousandth of what it was when first seen.

According to Sir John Herschel, the explanation of this peculiar contraction in Encke's comet is optical rather than real, "that near the sun a part of the cometary matter becomes invisible, having been *evaporated*, perhaps, by the solar heat, just as a cloud of fog might be."

THE ST. LOUIS EXPOSITION OF 1903.

The preliminary work is progressing with much vigor at St. Louis for the Louisiana Purchase Exposition, and the current month will show the selection of a site for the Exposition. The organization is proceeding with the fully formed purpose of having the Exposition open on May 1, 1903. We are informed by the Secretary, Mr. W. B. Stevens, that work begins with a capital of $15,000,000, fully secured. In June, 1900, Congress made a part of the Sundry Civil Bill a section pledging an appropriation of $5,000,000 to the Exposition, if the organization of St. Louis should show, to the satisfaction of the Secretary of the Treasury, $5,000,000 raised by popular subscription and $5,000,000 of bonds voted by the city of St. Louis. At the following election in Missouri, November, 1900, the Constitution of the State was amended not only to permit the city of St. Louis to issue $5,000,000 in bonds, but also to authorize an appropriation of $1,000,000 by the State for its own participation in the Exposition. Since that election, the Legislature has carried out its part by making the appropriation of $1,000,000. The Municipal Assembly has by ordinance authorized the issue of bonds, and the people of St. Louis have subscribed for over $5,000,000 of stock. In February of this year, the Secretary of the Treasury was furnished with the evidence that subscriptions for the full amount stipulated by Congress had been secured, and that the bonds had been legally authorized. He certified these facts to Congress. A special committee reported the bill providing for an appropriation of $5,000,000, and the House passed it by more than a two-thirds vote. The action of Congress in appropriating $5,000,000 to the Exposition, making the government a financial partner to the extent of one-third, constituted the most notable provision yet made in the history of exposition legislation. President McKinley has appointed a government commission, and the first meeting has been held in St. Louis.

Those who have visited the Pan-American Exposition at Buffalo have admired the splendid arrangement, the architecture, the landscape gardening and the lighting. It is a triumph and exceeds any other Exposition in beauty. All this was accomplished with $5,800,000 capital and appropriations. With such a sum as $15,000,000 there is no question that St. Louis can give the most artistic though not the largest exposition ever held.

TWENTY-FIVE KNOT NAVAL SCOUTS.

At the Annual Conference of the Institution of Naval Architects in London, Rear Admiral C. C. P. Fitzgerald outlined a scheme he has had formulated for scout vessels of high speed and good seagoing qualities. His idea is by no means original, for the French government some two years ago sanctioned the construction of two such vessels for the purposes advocated by Rear Admiral Fitzgerald, although so far they have not been constructed. The vessel suggested by this officer would be a twin-screw steamer 400 feet in length, with a beam of 44 feet, 3,800 tonnage, draught 14 feet, 17,000 horse power, and a continuous ocean speed of 23 knots, rising, if the exigencies demanded it, to 25 knots per hour, a bunker capacity of 1,200 tons, and a normal supply of 500 tons of coal. She would be provided with a protective deck 2 inches thick on the slope, and would carry six 4-inch guns, with twelve machine guns. Although not intended for fighting purposes, she would yet be capable of defending herself against torpedo attack. The radius of action of this scout would be 1,500 miles at 25 knots, 2,000 miles at 23 knots, 3,000 miles at 18 knots, and 8,500 miles at from 10 to 15 knots. The maximum speed would enable her to escape from first-class cruisers. Her estimated cost would be $1,350,000. Commander Clover, of the United States Navy, who entered into the discussion, remarked that in the Spanish-American war the Americans employed liners such as the "New York" and "St. Paul" for this class of work, and they were found to fulfill all the necessary requisites, either as dispatch or scouting vessels. The result of their experience had convinced them that it was undesirable to construct special vessels as scouts, since in order to be efficient the vessels would have to be of large dimensions, so that high speed might be maintained at sea at all times.

SCIENCE NOTES.

The excavations in Carthage are producing excellent results. The Punic necropolis near the altar of St. Monica, at Carthage, has resulted in the finding of painted terra cottas, censers, figurines of women, bronze razors and engraved inscriptions of human beings, birds, etc., amulets of gold, silver and ivory.

The eminent French chemist, M. Armand Gautier, has reported a discovery to the Paris Academy of Sciences which may prove of great hygienic value. He has found that finely powdered volcanic stones, treated by boiling in water at a temperature of 250° to 300° Celsius, yield a liquid identical in composition with the ordinary sulphur water of mineral springs, except that it is stronger than the latter.

Dr. Harlow Brooks has been appointed pathologist to the New York Zoological Park. The animals furnish a splendid field for the study of comparative pathology. A laboratory will be fitted up for Dr. Brooks' use. He will make regular visits to the park to examine into the hygienic conditions of the animals and recommend such treatment, and to make such autopsies and microscopic studies as will tend to advance our knowledge of the prevention and treatment of diseases peculiar to animals.

Celluloid has always been manufactured by dissolving nitrocellulose in camphor—that is to say, forming a mixture of nitrocellulose, camphor and alcohol. But there are other ways of mixing it. According to a publication of the Société Générale pour la fabrication des matières plastiques de Paris, celluloid can be made by using naphthalene instead of camphor. The celluloid thus produced, the paper adds, is just as good as, if not better than, that in which camphor forms one of the ingredients.

The Surgeon-General of the United States Army has approved the report of a special medical board by which the conclusion was reached that the mosquito is responsible for the transmission of yellow fever, and the medical department of the army is moving energetically to put into practical operation the methods of treatment for prevention of yellow fever, involving a radical reversal of the existing methods, which form the basis of the report. The liberal use of coal oil to prevent the hatching of mosquito eggs is recommended.

German papers report that an Englishman, Mr. H. Houbon, has invented a process for making very pure hydrogen from acetylene. He condenses acetylene in a Cailletet steel bomb up to 5 atmospheres, and ignites it by means of electricity. Hydrogen and carbon are formed; the latter precipitates in the form of fine soot. The process is without danger and makes it possible to generate hydrogen on a large scale very cheaply. This invention may mean much for balloon technics, as the present methods of making hydrogen are expensive.

Prof. Dr. Voges, the director of the National Board of Health at Buenos Ayres, according to German papers, has found a remedy for mosquito bites. He states that he discovered it by accident during his trip to Paraguay to study the pest. He had been supplied with all sorts of remedies, among them naphthalene, an article of no value whatever against the pest; but on using it for mosquito bites, he found it of surprising effect. It neutralizes the poison, even when the spot bitten is greatly inflamed. If fresh bites are rubbed with naphthalene, no swelling follows. The professor considers naphthalene almost a specific against mosquito poison.

The State of California has appropriated $250,000 to purchase and preserve the grove of redwoods near Santa Cruz. This excellent work was accomplished largely through the agency of a body of Californians especially organized for the purpose, called the Sempervirens Society. The area purchased is unfortunately not very large, and the finest redwoods are found further north. Several thousand acres of land will be purchased in the neighborhood of Humboldt Bay, running from the ocean back across the summit of the coast range. Two or three millions of dollars would be sufficient to make the entire purchase, and the government would do well to preserve this wonderful collection of forest trees for all time.

The heavy yoke of paternalism weighs on the pharmacists in Germany, says The American Druggist. Every detail of the practice of pharmacy is closely supervised by the government. No smoking, no loud and unnecessary conversation are allowed in stores and no domestic animal can be tolerated in them. The pharmacists are being gradually replaced by the "drogisten," who are only permitted to sell the simpler drugs and medical supplies, but cannot dispense prescriptions, and can only sell poisons under special restrictions for household use. Licensed pharmacists are required to be present in their stores from six A. M. to ten P. M., and during the night must be at all times ready to respond to the call of the applicant for even trifling amounts of drugs.