1,579, or approximately 1,600 light years. He finally expresses the opinion that the smallest and faintest of the white nebulæ may be galaxies at a distance of 1,000,000 light years, thus advocating the theory advanced by Herschel, that our stellar system is quite limited in extent, and of the form of a spiral nebula, and that the spiral nebulæ are similar systems separated from ours by vast distances.

Some have found a difficulty in reconciling the above moderate estimate of the distance of the Milky Way with the accepted fact that the stars having sensible proper motions are probably much nearer than the Milky Way, and have smaller parallaxes than that corresponding to the above estimated distance. It may also be observed that as the spiral nebulæ congregated in the neighborhood of the galactic poles, they are probably part of our stellar system; certainly that fact does not strengthen the view that these nebulæ are separate systems.

It occurred to me recently that an estimate of the distance of the galaxy may be made by a purely geometrical Process, which is here given for what it is worth. It has been shown that the galaxy is not quite a great circle of the celestial sphere, but lies in about 1°.7 south galactic latitude, showing that the solar system is a little to the north of the Salactic plane. This conclusion is strengthened by the ob-



Hypothetical Form of the Universe. Section Through the Poles of the Galaxy.

served greater star density in the direction of the south pole than in that of the north pole, Seeliger having found the density densities to be 3.14 and 2.78 respectively, per square degree. If it be assumed that this difference of density is due solely to disc to differenc of distance, the distances of the poles of the salar salaxy will then be to one another in the ratio of the additoots of the above star densities, or .96. Then if the additional assumption is made that the galactic plane divides the stellar universe equally, it is found that the distance of the solar miverse equally, it is found that the distance of the solar system to the north of the galactic plane is .or of the Polar diameter of the universe. The angle subtended by this diameter of the universe. this distance at the centre of the galactic region being 1°.7, the distance at the centre of the galactic region diameter is the distance at the centre of the galactic region diameter is found to a set of the galaxy in terms of the polar diameter is Polar diameter of the universe is about 6,000 light years, the

distance of the galaxy is 2,052 light years. Taking this as the distance to the central region of the galaxy, and assuming, as shown by Professor Campbell's investigation, that its nearest part is distant about 500 light years. years, the farthest portions will then be about 4,600 light years from the sun.

This estimate fits in well with the distance to the limits of the universe in the region just outside the Milky Way, found from its star density, and Newcomb's conclusion that the Milky Way lies partly within the space occupied by the non-galactic stars.

In a brief survey of such an extensive field it is impossible to cover the ground completely, so I have merely attempted to give a general view of that portion of it marked off for examination at the outset. Astronomers realize that problems of the universe cannot be solved in a generation; that results can only be achieved by the co-operation of the present generation with those to come; each contributing its few grains of truth, which will finally be arranged in order. The astrographic chart of the heavens, now nearing completion, is the noblest legacy which the present generation as astronomers can bequeath to future generations. In their hands, by a repetition of the work, it should be the means of giving an insight into some of the problems of nature, about which at present we can only conjecture.

This principle of co-operation, though general in science, specially exemplified in astronomy, as its history shows. Tycho Brahe, though adopting erroneous views of the solar system, provided Kepler with the accurate positions of the planets that enabled him to formulate the laws which bear his name. These, in their turn, laid the foundation of a mechanical theory of the solar system, which, as developed by Newton and his successors, has made astronomy what it is to-day, giving us an almost perfect knowledge of the motions of the bodies of the solar system. Again, the foundation of stellar astronomy may justly be said to have been laid by Bradley, who made the first accurate observations of the positions of the stars. His catalogue, re-computed by Dr. Auwers in 1882, is the basis of our knowledge of proper motions, upon which many of the modern theories of the universe are built. Astronomers of to-day are doing their share in handing down to posterity the great star map. They, in their turn may, a century hence, find it necessary to repeat the work, extending it to include stars of the smallest observable magnitude, in order to advance knowledge of the stellar universe another step towards the final goal; which probably can only be approached asymptotically, by successive approximations, each vantage point being reached by a continually increasing amount of labor.

FORT WILLIAM'S PUBLIC UTILITIES.

The annual report of the manager of Fort William's utilities for the year ended December 31st, 1912, shows that there has been a net gain of \$4,025.04 in the telephone department during the year as compared with a deficit from the operation of this utility during the year of 1911 of \$2,728.30.

The increase in the surplus of the light department is \$21,085.19, as compared with a gain of \$13,309.28 during the year 1911.

The revenue and expenditure in the three utilities, light, water and telephone, are as follows :-

Water Operation .- Total revenue, \$75,091.74; operation, debenture interest and sinking fund, \$88,015.14; deficit, \$12,923.40.

Light Operation .- Total revenue, \$99,310.97; operation, debenture interest and sinking fund, \$78,225.79; profit, \$21,-085.18.

Telephone Operation .- Total revenue, \$44,684.73; operation, debenture interest and sinking fund, \$40,659.69; profit, \$4,025.05.