During the past thirty-five years a major effort has been made to measure the line-of-sight speeds of the stars. This is done by making precise and exacting measurements of the positions of the radiations upon the photographs of stellar spectra. The velocities of nearly 4,000 stars have been measured. More recently much attention has been given to the problem of the determination of the distances of the stars which have been measured for velocity. The methods developed for this task have given the distances and intrinsic brightness of nearly 2,000 stars. In the course of these researches much has been learned about the properties of the material in interstellar space, its composition, motions and distribution and its effect upon the transmitted starlight.

The material thus accumulated has permitted a description and study of the universe to a distance of about 5,000 light-years from the sun. The earth's sun is a typical star of the galaxy, known as the Milky Way system, a lens-shaped aggregation comprising probably some 40,000,000,000 stars with an equal mass of dust and gas scattered between them. This enormous galaxy is about 70,000 light-years in diameter and is rotating about its centre. The earth's sun, approximately 25,000 light-years distant from the galactic centre, requires over 200,000,000 years to make one revolution.

The Observatory has played a leading role in the discovery and study of close double stars. These are systems of two stars in rapid revolution about their centre of gravity and so close to one another that they cannot be seen as two separate stars but must be studied with the spectroscope by means of which calculations are made of the sizes, masses, mean densities and energy output of the two stars. Double-star astronomy is essential to an understanding of the stars for (apart from the sun) it is almost the only source of information on the masses and dimensions of these objects which are of such importance to studies of the universe. Moreover these observations of double stars demonstrate the applicability of the law of gravitation throughout the stellar system as well as in the vicinity of the earth and sun.

The Observatory also carries out investigations into the physical and chemical nature of the stars by making detailed measures of the relative amounts of energy at various wavelengths in the emitted starlight. Thus information is obtained on the chemical composition of the stars and the relative abundance of chemical elements in the universe, as well as on the temperatures and pressures prevailing in stellar atmospheres and the motions and forces involved in the interaction of matter and radiant energy. The stars studied range from the very hot objects where matter is reduced to a relatively simple state, to the cool stars in whose atmospheres chemical compounds are able to exist.

The Observatory's spectroscopic analyses are of interest apart from astrophysics. They allow the study of atoms under conditions not yet produced in terrestrial laboratories and in the presence of a field of radiant energy not attainable on earth. The information from these astrophysical studies advances the knowledge of terrestrial physics and chemistry and the understanding of atoms and atomic processes.

The David Dunlap Observatory

Professor C. A. Chant pioneered in the teaching of astronomy in Canada. He joined the staff of the Department of Physics at the University of Toronto in 1891 and, being interested in astronomy and particularly in the then new subject of astrophysics, energetically strove to improve the position of astronomy at the University. In 1904 his efforts were rewarded by the establishment of a graduate course entitled 'Physics and Astrophysics', and Dr. Chant was appointed head of a newly created sub-department of Astrophysics. This later became the Department of Astronomy with Dr. R. K. Young as assistant. During these years most of the professional astronomers in Canada received their training in Dr. Chant's Department and he felt increasing need for an observatory for astronomical research to aid in this training. The David Dunlap Observatory was the outcome of his tireless efforts to fill this need.