SPECTRUM ANALYSIS.

A FEW days ago several of the students, who were out to enjoy the cold morning air witnessed a peculiar and pleasant optical phenomenon. The light snow which had abundantly fallen during the night was readily dispersed throughout the atmosphere by a soft breeze, so that it hung as a thin cloud above the ground. The sun, which was just then rising behind the neighbouring buildings, pierced through this crystalline cloud and emerged in three or four places clothed in the most brilliant colors. One of the observers was pleased to call these variegated pillars of crystals *snow-bows*. The name gave a wrong idea of the form of the luminous streak, but it thoroughly explained the cause of the phenomenon, which was the same as that of the rainbow. For, the light of the sun while passing from the air to the denser medium of the snow crystals, is bent or refracted. It is decomposed into its constituent elements, the seven prismatic colours.

This phenomenon, the beauties of which nature also displays before our eyes in the bright colours shed by the rising and setting sun, and in the dim hues of the halos and coronas, we will likewise reproduce artificially. If a small aperture be bored through a shutter in a dark room, a luminous pencil of light will at once pierce through the obscurity, illuminating the minute particles of dust that are continually dancing in its path. If this pencil is made to fall on a prism, it will alter its direction and emerge under the form of the seven prismatic colours. These colours, which are the red, the orange, the yellow, the green, the blue, the indigo and the violet, will be bright and distinct, and will constitute a spectrum.

The colours can be rendered still more distinct if the pencil of light be focussed on to the prism by means of a lens. The spectrum thus obtained, if closely examined with a microscope, will no longer present a pure and continuous spread of colours, but rather a succession of bright bands and dark hues. This fact which is so easily related, was a revelation to physicists. It opened to them a region replete with scientific truths, until then shrouded in darkest mystery. This discovery, slowly unearthed by Melvil, Wollaston, Fraunhofer and Angstrom, became, through the deep and patient researches of Kirchhoff and Bunsen, the basis of spectrum analysis.

To penetrate more deeply into the hidden treasures of this new science a tool of great strength and extreme sharpness was required. Bunsen and Kirchhoff improved upon Fraunhofer's primitive instrument, and gave to the world the spectroscope now universally used. The distinct and magnified images which it gives of the spectrum, the comparative views of the positions of both dark hues and bright bands when referred to some fixed scale, and the facility of examining simultaneously the spectra of varied elements, have made it a means of penetrating into spectrum analysis, which in its infancy has already taught a wonderful lesson to the veteran science which has dawned in the days of the alchemist and to the more antique and lofty study which the astrologist of old fostered in the shade of the pyramids.

Provided with this means, the task of determining the nature of the spectra is feasible. Let us place a small quantity of potassium in the flame of the Bunsen burner, or better, in an electric spark, the intense heat of the electric fluid will melt the element and cause its vapors to emanate. If the light produced by these vapors be decomposed in the prism of the spectroscope, the observer will notice a spectrum in which two bright red bands on the right and one violet band on the extreme left, will predominate. This experiment can be tried over and over again, and the same bands and no others will always appear, and their position will not deviate by a fraction of a millimetre. Let silver now be submitted to the same process. In the midst of it will appear a bright green band, extremely well defined. The rest of the spectrum will be dark, but the green line will be perfectly distinct. If now both metals be fused together, the three lines will spontaneously arise, each in its definite place. If all other metals be treated in the same way, whether they