Stellar Studies in Bulk

The nineteenth century saw astronomers take on studies of stars in bulk. Of particular interest were the clusters of stars and the nebulae. With his large telescopes including the 48-inch reflector, William Herschel made pioneering discoveries which led to the first attempt at finding the structure of our Galaxy.

The key feature of this structure which is visible to the naked eye on a clear night is of course the Milky Way, a white band stretching across the sky. By counting stars in different directions, Herschel demonstrated that they are concentrated in the plane of the Milky Way. If we imagine ourselves as located in this plane then looking out, we would see the stars in the "disc" projected in a band. Today, we call this disc of stars the "Galaxy".

Herschel found the star clusters to be distributed mainly in the plane of the Milky Way; the nebulae, however, seemed to avoid that plane. Unlike the stars, the nebulae have a diffuse cloud-like appearance and Herschel thought them to be components of the Milky Way system. Some indeed seemed to have a central star.

Back in the eighteenth century, the mathematician J.H. Lambert had suggested that by and large the nebulae were large clusters of stars - they were galaxies like our Milky Way Galaxy, but because they happened to be very far away they looked small and one could not make out their starry character. However, Herschel thought otherwise: because these nebulae avoided the plane of our Galaxy he felt that their distribution was somehow related to the structure of the Galaxy. Herschel's studies also led him to believe that our Sun and the Solar System were located very close to the centre of the Galaxy.

Eventually, these conclusions of Herschel proved to be wrong. The crucial aspect of the cosmos that he had not been aware of was the presence of dust. Like stars, clouds of dust particles are also concentrated in the disc of the Milky Way, thus obscuring the view of all distant objects lying in that plane. Which is why no nebulae are seen in the galactic plane. It was the dust obscuration that also misled Herschel about the true extent of our Galaxy and our location in it. But the real picture emerged only in the present century.

However, so far as bulk studies of stars are concerned, the most ambitious project was *Boner Durchmusterung*, a catalogue of over 300,000 stars published by Friedrich Argelander between 1852 and 1862. Modern catalogues are based on this mammoth work which is all the more remarkable because it was done without the use of photography.