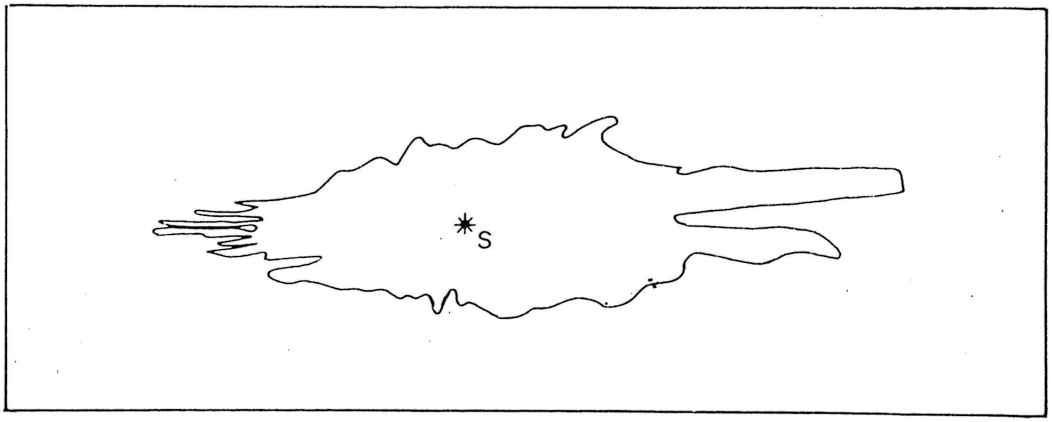
The Galactic Centre

Late in the eighteenth century, William Herschel had begun measurements of stellar distances, starting with the assumption that stars are basically similar to the Sun. Thus, the fainter the star the farther it would have to be. By counting stars to fainter and fainter magnitudes, Herschel was able to get a qualitative picture of their distribution in what became known as the Galaxy.

It was thus he found that stars are largely distributed within the plane of the Milky Way and that the Galaxy of stars extends farther in the plane than in the perpendicular (polar) direction. This disc-like distribution was reflected in the map of the Milky Way (see Figure) drawn by Herschel. In retrospect, it turned out not to give the entire picture, but given the limitations of observations two centuries ago, it was a step in the right direction.

As seen in the picture, the Sun is at the centre of the Milky Way. This belief survived throughout the nineteenth century and when towards its end, J.C. Kapteyn planned a large scale programme of spectroscopy and photometry of stars in the Milky Way so as to determine its structure, he was guided by the same belief. The outcome of this work led to the *Kapteyn Universe* in 1922, in which the entire system was believed to be 10,000 light years in diameter and centred on the Sun.

By 1918, however, thanks to the work of Harlow Shapley, picture of a different and larger system was emerging with the Sun well away from the centre. Shapley determined, with the help of measurements of angular sizes of globular clusters (these are spherical distributions of stars) that the true centre of the Galaxy lies in the direction of Sagittarius. His estimate of the diameter of the Galaxy at 300,000 light years, however, turned out to be too large by a factor three. This was because he had not taken into account the attenuation of starlight by interstellar dust... an effect that became known and established in the 1930s. After an initial period of controversy between the Kapteyn and Shapley schools of thought, the latter prevailed.



Herschel's map of the Milky Way with the Sun *S* at the centre