Precision Measurement of Dust Distribution in Milky Way

The spatial distribution of dust in a galaxy contains important information about the structure and evolution of that galaxy. Observations of extragalactic galaxies have shown that dust is abundant in disk-like galaxies, which itself also forms a remarkable disk-like structure. In general, dust disks appear radially more extended and thinner than stellar disks. For instance, the different spatial distributions of dust and stars make up the famous image of the Sombrero Galaxy.

Using the massive stellar spectral data obtained by the Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST) sky survey, researchers at the Shanghai Astronomical Observatory, Chinese Academy of Sciences were able to model the structure of dust component in the Milky Way and give the most accurate scale by far of the Galactic dust distribution.

The team conducted an independent analysis of the stellar spectra and released a value-added catalog of a sample of millions stars, which listed the interstellar dust extinction values to all the sample stars. Then, with these extinction values, the researchers successfully constructed an analytical model for the overall spatial distribution of the interstellar dust in the Milky Way.

The study showed that the overall distribution of the interstellar dust in the Milky Way can be well described by a disk-like structure with an exponential decrease in both radial and vertical densities, after subtracting two very prominent substructures near the sun. The scale-length of the dust disk is up to 10,000 light-years, while the scale-height is only about 330 light-years. In contrast to the structural parameters of the Milky Way's stellar disks, the Galactic dust disk is also more stretched on the radial scale and thinner in the vertical. That is to say, if we are far away enough, the Milky Way we see will be very similar to the Sombrero Galaxy from the edge-on view.

The hat-shaped Sombrero Galaxy, also known as M104, seen from the Hubble Space Telescope. (Credit: NASA/Hubble Heritage Team)

The research has reached unprecedented precision in the measurement of the overall structure of the Milky Way dust component, which is attributed to the massive data provided by LAMOST. Their paper has been accepted for publication in the *Astrophysical Journal*.