The problem with binning

Unfortunately, typically analyses do not realise the full potential of these beautiful datasets. The data is usually spatially binned, resulting in an unfortunate, and mostly unnecessary, loss of information.

To compound the problem, the models employed are often overly simplified and make several assumptions which are not always astrophysically justified. This significantly reduces the number of reliable and robust results.

Why discrete fitting?

\begin{itemize}
\item No loss of data, improved membership selection, chemical tagging.
\end{itemize}

Using discrete datasets is not always possible. For nearby galaxies with unrepeatable imaging and spectroscopic data, nature has already binned the data for us. In these cases, binned data is the best we can do, and the dynamical models developed to study these objects have been proven to work very well indeed.

However, where it is possible, discrete fitting has many advantages:

\begin{itemize}
\item No loss of information
\item Improved membership selection
\item Chemical tagging
\end{itemize}

● Figure 1 and 2 highlight the loss of information incurred by binning a sample of stars. Figure 1 contained 1982 Carina stars for which line-of-sight velocities have been measured. Figure 2 shows the same sample in radial bins, of which there are just 27.

● Figures 1 and 2 highlight the loss of information incurred by binning a sample of stars. Figure 1 contained 1982 Carina stars for which line-of-sight velocities have been measured. Figure 2 shows the same sample in radial bins, of which there are just 27.

How? First Jeans then Schwarzschild.

Dynamical models using binned data work by first calculating the velocity distribution in a given bin - mean, dispersion and higher order moments where the signal-to-noise is high enough - as shown in Figure 6. Then, for a given model, the predicted and observed velocity moments are compared.

Science goals Dark matter, IMBHs, fossil records.

With these discrete fitting methods, we hope to:

\begin{itemize}
\item better constrain the dark matter content of dwarf galaxies, in particular the cored or cusped nature of their central regions,
\item address the presence (or absence) of intermediate mass black holes and dark matter in globular clusters,
\item identify in phase space fossil records of Galactic formation.
\end{itemize}

References