Young stellar clusters: from ISO to FIRST

Timo Prusti,
Astrophysics Division, Space Science Department of ESA

Young stellar clusters can be studied statistically to address various fundamental questions of astrophysics: initial mass function (IMF), star forming history and early stellar evolution. Significant amount of ISO time was dedicated for these purposes to map close by star forming regions: Chamaeleon I, rho Oph cluster, Serpens, R CrA cluster, LDN 1641, NGC 1333, parts of the Taurus clouds etc. The results are consistent with a scenario where the high activity of star formation is only of short duration. The IMF if consistent with that of field stars with an extension toward brown dwarfs mass domain with the same power law as for very low mass stars.

One of the interesting results of the ISO studies of young clusters is the clear separation of stars with and without infrared excess when observed at 6.7 and 14.3 micron. The importance of this result is due to the fact that it is very difficult to disentangle infrared excess from extinction if only ground-based near-infrared JHK data is available. The reason for superiority of ISO data in this respect is due to the low and very similar extinction at 6.7 and 14.3 micron. Therefore the observed ISO colour is very close to the intrinsic colour. The gap in the ISO [6.7]-[14.3] colour separates clearly stars with and without infrared excess. Furthermore, the lack of intermediate cases suggests that the disk dispersal, when started, is a very rapid process.

The disk dispersal time is going to be one of the key issues to be addressed by FIRST. Young stellar clusters provide an excellent target to probe this process. Ground-based and ISO results indicate that circumstellar disks disappear before stars reach an age of a few times 10^7 years. However, this is true only for the inner parts of the disk. The dispersal of the cooler parts can only be addressed at wavelengths longward of 60 micron, but at these wavelengths IRAS, ISO and SIRTF all hit the problem of confusion. It is the resolving power of FIRST which will be crucial in addressing the dispersal time scale of the cooler parts of the circumstellar disk. This information is needed to see if the inner disk dispersal seen in young clusters have any relation to the debris disks in field stars which have dispersal time scale of the order of 400 million yers.

This presentation will review the ISO results of star formation history and IMF in young clusters and show the expected contribution of FIRST in this science area. The current understanding of disk dispersal will be reviewed and the need for FIRST will be discussed to show the potential in clarifying the issue of dispersal of the cooler parts of the circumstellar disks.