SUMMARY

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I would like to pick out a few items that I found particularly interesting. The choice probably reflects my ignorance, because many of these topics are no doubt more known to most of you. I am fairly sure that some of them are basic and important. We will start with the first session.

There were three closely related papers on the evolution of massive stars, the formation of open clusters and associations and the IMF. We learned that clusters appear to form in initially bound clouds of masses between 10^4-10^6 $M_\odot$, but star formation is a destructive process. Most of the gas is lost and the remaining stars then find themselves in an unbound system, which naturally disperses on a dynamical time. As a result of this, star formation is typically a fairly inefficient process, at least on the scale of open clusters. However (as Heggie pointed out) it seems to be somewhat more efficient on smaller scales, as evidenced by the fairly high incidence of binary stars. To form a bound cluster requires a higher efficiency of star formation, typically 30% or more, and we see how the three papers of this morning session relate: the initial mass function and the timing of where and when the OB stars form dictate the likely fate of the system. To survive, a young open cluster needs to be a very compact system which will then expand, but still remain as a bound system when its gas is lost. I would like to know how to make the Magellanic young (populous, blue) globular clusters, which are typically 10^4-10^5 $M_\odot$ and 10^7 years old: how would they fit into this sort of picture? Here we are looking at star formation that needs to be on the scale of 30 Doradus, but yet needs to remain bound, because these systems are indeed quite tightly bound now.

J.-P. Swings (ed.), Highlights of Astronomy, 567–569.

The second session was on molecular clouds in galaxies. From the galactic data we saw that the giant molecular clouds are found primarily in spiral arms, while in between the arms are found mainly smaller clouds. Together with the nice data for other galaxies and for M51 in particular, this points to the picture of giant clouds forming from agglomerations of smaller clouds and then being destroyed by star formation on a time scale of about $5x10^7$ years. This agglomeration process may well be driven kinematically by the spiral density wave itself, whose role is then to create giant molecular clouds rather than leading directly to star formation in the spiral arms themselves.

The third session was on the subject of young components in galaxies, and started with giant HII regions. These are systems with a high local rate of star formation and are concentrated to the spiral arms of spiral galaxies. Their internal kinematics, we learned, are dominated by OB and Wolf-Rayet stars and supernovae, and the luminosity functions of stars in them are similar from galaxy to galaxy, at least at the bright end. This points us towards the concept of self-regulating star formation, in which the energy input from star formation affects the gas density and through it the spiral modes themselves: from recent work, this concept may play a crucial role in spiral structure dynamics. Dopita's work, which uses a somewhat different version of self-regulating star formation, shows that many properties of the galactic disk, including the properties that we now think of as properties of the old disk, can be closely tied to this whole process of self-regulation. It may be an exceedingly important process, not just for what we have seen here, but really for the entire history of the Galaxy.

Then came a discussion of star-forming regions in irregular galaxies, including the dwarf irregulars, and we saw how these giant star-forming regions have similar properties to those of the much larger spirals. Clearly spiral structure is not needed to produce these giant star-forming regions. The processes leading to them are as yet not understood, but maybe (as Stark pointed out) the basic giant molecular cloud forming mechanism works anyhow even without density waves, and all the density wave does is to provide a convenient trigger. Then came a very interesting discussion on the relationship of dark nebulae and the thermally emitting dust to the star formation and molecular regions.

Finally there was a discussion of chemical evolution of galaxies, beginning with the (oxygen abundance)-mass relation for low-luminosity irregulars. It was argued that this relation is really fairly similar to the abundance/mass relationship for ellipticals, and it follows that there is no real evidence for a variable yield in these systems as would have been given by a variable slope of the IMF. In any case, the yield, variable or not, is low and there is a need to invoke something like the Hartwick mass loss process to reduce the yield to this low level. We also got a nice confirmation of Peimbert's estimate of the primordial He abundance. Then came an interesting discussion on the rarity of star bursts and the importance of interactions. And finally we had an outline of the Scalo Struck-Marcell idea of star bursts in a cloud coalescence-disruption scheme, and the notion that a delay in this coalescence-disruption scheme can lead to very large clouds forming before disruption and, of course, the relevance of this to star bursts.

As a non-specialist I found this day very exiting and informative. I would like to offer our thanks to all the speakers, and particularly congratulations to Gösta Lyngå for a very nicely organised joint discussion.

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