A SEARCH FOR "YOUNG GALAXIES"

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1. INTRODUCTION

Among the most interesting objects found on low dispersion IIIaJ objective prism plates taken with the UK Schmidt telescope are a large number of compact and intrinsically very bright 'extragalactic HII regions'. Spectroscopically they are indistinguishable from the giant HII regions found in spiral and irregular galaxies except that they are much more luminous with absolute magnitudes in the range M_V -14 to -23. The stellar continuum is extremely blue indicating a predominantly young stellar population. The Hβ luminosities, 10^{38} to 10^{42} ergs/sec indicate that they must contain 10^5 - 10^7 OB stars with a total mass in stars of 10^6 - 10^9 $M_\odot$. The associated high rate of star formation cannot have continued for more than 10^7 years, which implies that these systems are either undergoing star formation for the first time, or that they undergo intermittent bursts of star formation. The chemical composition of these systems is also remarkable in that the oxygen abundance is invariably less than solar.

Terlevich and Melnick (1981) have shown that for isolated extragalactic HII regions there is a strong correlation between the velocity dispersion (σ) and Hβ luminosity. More importantly they show that the velocity dispersion is also a function of metallicity and if this is allowed for, it considerably reduces the dispersion in the σ/Hβ relationship permitting the use of HII regions as reliable distance indicators. The HII regions are therefore not only important for studies of star and galaxy formation but promise to provide a valuable new cosmological probe.

2. LOW REDSHIFT SURVEY

Our initial laborious visual searches of objective prism plates have led to the discovery of a few hundred extragalactic HII regions. A large spectroscopic survey of all Tololo, Cambridge, and Markaryan emission line galaxies is under progress. At present the sample is 50%

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complete, with spectra of more than 250 galaxies already collected. This data is presently under analysis but one interesting result has been that none of our sample has an oxygen abundance less than 1/20 solar. One possible explanation is that many of our objects are more luminous and have stronger lines than IZw18, which has an oxygen abundance 1/40 solar.

IZw18 the prototype "Young Galaxy" was discovered independently by both Zwicky in his searches for compact galaxies and by Markarian in his search for galaxies with ultraviolet excess. It is now possible to combine both these search techniques, in an automatic survey using the APM at Cambridge. A sample of compact galaxies is selected from the direct plates and the objective prism spectrum analysed either automatically using PRS (Hewett et al. this conference) or manually. This sample should contain the weak-lined and fainter objects absent from our manual searches. A search for blue compact galaxies in one field has led to the discovery of several extragalactic HII regions missed in our visual survey. It is from this sample that we hope to find young galaxies with metal abundances comparable to, or less than IZw18.

3. HIGH REDSHIFT SURVEY

The HII regions are discovered by their strong [OIII] 5007 emission and hence the IIIaJ surveys are limited to redshifts < 0.06. We have recently initiated a search using IIaD and IIIaF emulsions. The use of these emulsions in manual searches for emission lines presents some difficulties because of variations with wavelength in the emulsion sensitivity and the low dispersion of the UKST low dispersion prism above 5000 angs. This is not a problem with the new higher dispersion prism or the ESO prism. However, we have had some success with a few candidates in the range 0.07 to 0.2 (0.08 and 0.10 confirmed spectroscopically).

Recently we have discovered two HII regions with redshifts of 0.18 on IIIaJ plates by virtue of their strong OII 3727 emission. HII regions in the range 0.2 to 0.31 have been discovered by Arp (1983) and Osmer (1982) in their searches for quasars. We now have a sample of HII regions from zero redshifts out to 0.3.

Thus we have a powerful new tool for studies out to cosmologically significant distances and an easy method of studying the Hubble flow. A great advantage of these extragalactic HII regions over the QSO's is that their physics is relatively well understood.

REFERENCES

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