CONCLUDING REMARKS

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It was during the fifties that Academician Ambartsumian first raised the issue of the activity of nuclei of galaxies, long before the subject became fashionable. An elaboration on these ideas may be found for example in Ambartsumian's report to the 1970 Vatican meeting. The issues which he raised pertain to the physics of the nuclei and their interaction with the surrounding galaxy, and perhaps even beyond. In the meantime, a large body of data has become available and has been reported at this meeting, and it is clear that the activity of nuclei is of paramount importance, even though a common view on all aspects has not yet been achieved.

The first question is whether there is a significant central compact object inside every nucleus which manifests itself in the output of ionizing radiation, relativistic particles and other things. Much has been said here about Seyfert galaxies of various types (Sy 1, Sy 2, Liners, etc.) and the conclusion appears to be that low level nuclear activity is common and that some high velocity gas ($>$ 1000 km sec) is found in many galaxies. This seems to indicate that compact bodies are common, but perhaps objects of $\sim 10^6$ $M_\odot$ might suffice. The question as to whether more massive black holes are common is still open, as are questions like whether Sy 1 galaxies are relics of more powerful quasars or whether most galaxies at one time or another have been Seyferts.

The next question is whether there is a net flow into or out from the nuclei. Most of us appear to believe that gas, stars and perhaps other galaxies or at least their nuclei may fall into a nucleus and that high velocity gas and relativistic particles may come out. Some researchers also believe that whole nuclei may be ejected, but this point of view has not gained general acceptance. There are a number of points to be made here in connection with a too direct interpretation of what is observed:

Not every jet like feature is indicative of ejection from a nucleus. In some cases like the jet of M 87 ejection is plausible. But in other cases of interaction, the combined effects of

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hydrodynamic shocks and gravity may create large scale structures of a variety of shapes, resembling jets, spirals, etc.

Another point concerns the mergers of galaxies which seem to have moved all of a sudden to center stage. Undoubtedly, mergers do occur. However, it is a statistical problem to determine their quantitative importance: to every merger resulting for a short time in a galaxy with a double nucleus there must exist a whole variety of galaxies in other stages of merging and in premerger states. Very little work has been done to show that a statistically consistent picture can be made in which mergers are the dominant factor; the appearance of "invisible mergers" at this conference, of course, may be very helpful in overcoming problems !

Deviations from cylindrical symmetry are undoubtedly of importance. Angular momentum then needs no longer be conserved and mass accretion onto the nucleus is facilitated. This may be of much importance in the evolution of Seyferts and quasars. However, such deviations from axial symmetry may result not only from mergers, but also from the presence of bars and various instabilities.

Relativistic particles are certainly produced in many nuclei and are associated sometimes with jet like features. But the uncertainty as to what happens close to the center and the doubts about the interpretations of superluminal motions leave still much to be done.

To return therefore to the basic question of what happens in the nuclei, it still is too early to be sure that everything can be understood as due to mass inflow onto a black hole surrounded by an accretion disk. But it certainly is important to see how far one can get with the more "normal" physics, before introducing more exotic schemes.

The answer to the various questions that may be raised will ultimately have to come from observation, and it is here that major progress is being made. It has been exciting to see the progress that has come from the 6 m telescope with new detectors. More than half of the observational papers of our Soviet colleagues have been related one way or another to the 6 m telescope.

The future holds much progress. In the radio region of the spectrum the VLBI work on continental and intercontinental scales offers many opportunities especially when supplemented by a space based system like Quasat. In the infrared the European ISO satellite holds much promise, and in the uv the Space Telescope. In the optical a new generation of large telescopes like the 10 m California telescope, the 16 m ESO array and perhaps the 25 m USSR telescope are beginning to move from the drawing boards to reality. At X-ray wavelengths the situation is perhaps less certain, but much work has already been done on ROSAT, AXAF and XMM, three satellites of the post-Einstein generation with unprecedented sensitivity.

Finally, interferometry at optical and infrared wavelengths is showing prospects of moving out of the stellar field into the extragalactic area. With interferometers of a few hundred meters baseline, and with large enough unit telescopes for adequate

sensitivity, milliarcsecond resolution will be obtained - sufficient, for example, to resolve the Broad Line Region in nearby Seyferts. This certainly will put the current theories on a much more solid footing. When 20 years from now we shall again meet in Byurakan for the third symposium on the activity of the nuclei of galaxies, the subject will have been transformed very much indeed.

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