



a galaxian nucleus, one supernova might trigger off another in a chain-reaction sequence; but again energy release would be in all directions and too fast. A massive black hole in the galaxian nucleus, as discussed above for M 87 and with less confidence for normal galaxies, has been proposed, but as the source of energy for an extended radio source, it presents similar problems. An opposite idea is that there could be a **white hole** in the nucleus, and that material for the entire galaxy could be emerging from it. This has been considered particularly by Viktor Ambartsumian, who further suggests that entire clusters of galaxies could have emerged from such holes and still be dispersing, an idea which gives a possible resolution of the 'missing mass' problem.

Another class of theories, introduced by L. M. Ozernoy and developed by Philip Morrison and others, considers a rapidly rotating region in the centre of the galaxy, of  $10^8$ – $10^{10} M_{\odot}$  and called a **spinar**. Magnetic interactions at its outer edges would release energy. In a version due to Martin Rees, energy is released as a highly energetic plasma along the two ends of the rotation axis; thus a double structure is produced along a defined axis, as is observed. Such 'jet processes' are coming to be accepted as important in many unusual objects, both in accounting for the double structure of many radio sources, and also on a smaller scale for individual objects within galaxies. (An example of the latter is the object known as SS 433, which can be explained by a compact object accreting matter from a companion in a binary system and giving rise to two jets of energetic particles which are ejected along its rotational axis.) With a spinar, plasma and energy are supplied

