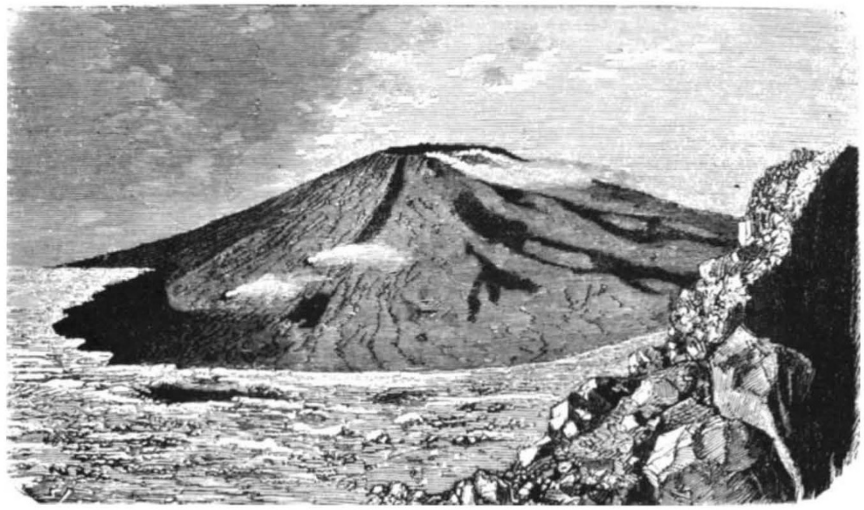
circular or rotating very rapidly. The remaining configurations are stable, at least up to third-order harmonic deformation. Apparently, rather elongated bars can survive when rotating slowly.

Increasing computational power has facilitated numerical studies of gravitating N-body systems. The main problem remains the simultaneous modelling of the long and the short range forces. Special techniques are needed to approximate both close encounters and global structure in such a way as to preserve the collisionless behaviour of the system. Robert Berman (University of Reading) gave a progress report on a potential-solving technique developed by Hockney and Brownrigg for a fully three-dimensional 25,000-body system. Studies of disk-halo models with halo potentials more realistic than those hitherto used, showed that the disk can be stabilised against bar formation if the halo is only marginally more massive than the disk. Also, if bars did develop, they often showed structure in their interior, in the form of nested rings or a smaller bar.

The considerable mathematical difficulties arising in the attempt to solve the Vlasov equation naturally lead to a search for shortcuts, preferably by assuming that the system can be described as a gas or similar continuum. An especially successful dodge was employed by Jim Bardeen (University of Seattle) to determine the unstable modes of a gaseous disk. He expanded the potential to first order in the disk thickness, and wrote the resulting equations in terms of Legendre polynomials. This enabled him to reduce the stability problem to a matrix eigenvalue equation. Truncating the matrix to 96×96, a set of growing modes emerged with some interesting properties. An increase in gas pressure decreased the number of growing modes, but did not reduce their growth rates very much. The potential of the modes was not a simple multiple of their surface density, unlike the WKBJ modes studied by others. Most significantly, the modes appeared to be superpositions of short-wave partial modes travelling inwards and outwards. The flow of gas induced in the plane of a bar-like potential depression was studied by Karl-Juhan Donner (Institute of Astronomy), who followed up Lynden-Bell's earlier suggestion, and by Takuya Matsuda (University College, Cardiff), who in collaboration with Sorensen and Fujimoto employed a 50×30 point fluid-in-cell method to obtain a numerical simulation of the gas flow in a barred spiral galaxy. Matsuda showed that standing shocks develop roughly parallel to the bar, through which gas is deflected so strongly that it rapidly assembles in the galaxy's nucleus. A second pair of shocks, detached from the first set, occurred near the region where the Keplerian velocity in the galactic plane equals the rotation velocity of the bar. The behaviour of motions out of the galactic plane, induced by shocks in the disk, was calculated by Alastair Nelson (University College, Cardiff), who found that the perturbations propagated almost vertically upwards, reaching considerable amplitudes in the tenuous regions at 300 pc height.

The last word, obviously, was for the observers, who produced something like a fascinating cold shower. Renzo Sancisi (Sterrekundig Laboratorium 'Kapteyn', Groningen) produced new radio maps obtained with the Westerbork synthesis radio telescope of NGC5383, the best maps of a barred spiral obtained to date. Gas was found concentrated near the ends of the bar and especially in the nucleus. Also, a low-brightness disk extending over a diameter of fully three disk lengths was observed, which made it possible to determine the rotation curve in this region. It appears that the central parts (out to half the length of the bar) rotate like a solid body. Thereafter the rotation speed stays almost constant. The bar was also seen in 1,415 MHz continuum, and deep plates taken by Van der Kruit and Bosma show that the optical extent of the galaxy is about as large as the neutral hydrogen disk. Evidence that even nicely-looking galaxies like M81 can be involved in spectacular events was produced by Leonid Weliachew (Observatoire de Paris, Meudon) and by Geoffrey Cottrell (Mullard Radio Astronomy Observatory, Cambridge) who described observations of the region around M81, M82 and NGC3077. These are surrounded by a huge hydrogen halo, in which the velocities of the gas clouds link up nicely with those of the galaxies. Cottrell presented a computer model of a tidal encounter between M81 and NGC3077, which properly reproduced the radio appearance of the latter. Presumably the hydrogen halo consists of debris left over from an encounter between M81 and M82. Finally, it was demonstrated that many spiral galaxies are not flat at all, perhaps necessitating some drastic rethinking of extant models. Darrell Emerson summarised an observational programme of the MRAO on M33 and M31, both members of the Local Group of galaxies. The plane of M33 was known to be warped, and the new observations conclusively showed the enormous extent of these distortions, with warps rearing above the plane to heights almost equal to the galaxy's radius. In M31, the Andromeda Nebula, smaller warps were discovered at the edge of the observable radio disk (about 30 kpc radius). Then Sancisi proceeded to show that possibly all spiral galaxies are warped: four members of a nearby, but otherwise random, sample of five spirals seen almost edge-on showed up to 20% warping of their planes. Two of these have no nearby companions, so that if the warps are due to tidal distortion during an encounter between two galaxies, the distorted galaxy must maintain a rather crisp warp during 4–5 galactic years at least. This baffling finding left the participants in the discussion appropriately wondering how much progress, exactly, has been made in understanding spiral structure. □



A hundred years ago

The Inclosure and Cone of the present Crater: The Volcano of Réunion. from *Nature*, **14**, August 17, 335; 1876.