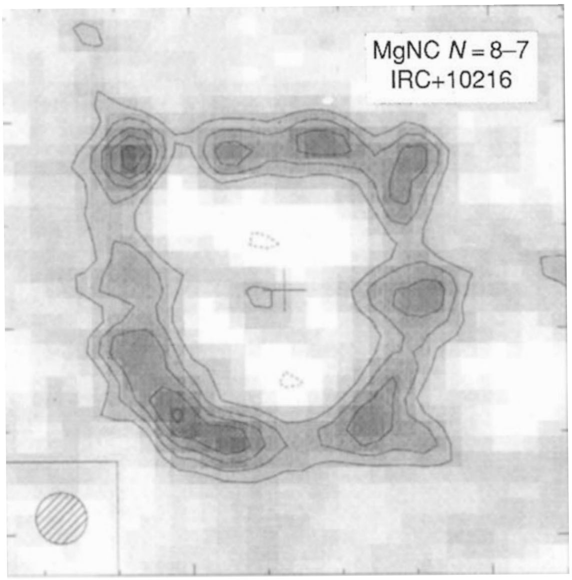
platelets and coagulate into soot particles or curl into fullerenes. The origin of the other kind of solid particles, silicate material, remains as unclear as it always has been.

Light pressure by itself cannot accelerate the gas to escape speed, and additional dynamic processes in the lower atmosphere are needed to explain the phenomenon. We have only the glimmerings of an understanding of what these processes could be. An added difficulty is that the flows of gases from and around the stars are often very clumpy (J. Dyson, Manchester Univ.); large separate pieces of dense material embedded in a smoother background affect the behaviour and appearance of the overall flow. The origin of these clumps is not understood, which brings some fundamental uncertainty into computer simulations of gas flows — just at the point when computer simulation of two-dimensional flows has become a well-established tool. Astronomical life would be easier without clumps but the clumps do seem to exist in planetary nebulae: molecules, by contrast to ions or atoms, have been found at their edges. The molecules ought to have been dissociated by strong, local ultraviolet radiation. But if the molecules are inside dense clumps, they might be able to survive (P. Huggins, New York Univ).

The large variety in appearance of planetary nebulae, showpieces for astronomical imaging (H. Schwarz, ESO Chile), is a result of only a few basic forms seen at different angles. These forms are a consequence of multiple, consecutive outflows of gases. For example, axisymmetric flows from the white dwarf star bumping into spherically symmetric flows from the earlier red giant stage cause focusing of the flows and density increases in axisymmetric rings (V. Icke and G. Mellema, Leiden Observatory; A. Frank, Univ. Minnesota).

Circumstellar material lies in great quantity around stars of high masses. A star that forms at 60 solar masses may lose 55 solar masses and never become a cool extended star before it explodes as a supernova (N. Langer, MPIA, Munich). Such a star develops into a brief-lived 'luminous blue variable', of which only a half dozen are known in our Galaxy (L. Smith, University College London). Luminous blue variables are related to Wolf–Rayet stars, which have massive wind outflows; but which are the mothers and which the children is not yet clear (Langer, Smith). Somewhat less-massive stars become blue or red supergiants, like the progenitors of SN1987A and SN1993J. A well-observed ring illuminated by SN1987A consists of matter ejected before the star exploded (C. Fransson and P. Lundqvist, Stockholm Observatory).



Emission from the molecule MgNC (N = 8–7 transition) forms a stunningly detailed image of the source IRC+10216 made with the IRAM Plateau de Bure interferometer, whose 5-arcsec beam resolution is shown in the corner. The central star (marked with a cross), is a nearby carbon-rich, low-gravity, cool, giant star which is losing mass at a great rate, the material having been dredged up from within. The emission at the star and in a cloud around it comes from carbon-chain molecules such as $C_2H, \ldots, C_6H$, cyanopolyynes, $HC_{2n+1}N$, and metal-bearing molecules such as MgNC, SiS, SiC_2 and NaCl, composed principally of elements produced from hydrogen processed in nuclear reactions in the star's core. Emission from the cloud is layered in shells because of molecular abundance gradients and excitation conditions. (M. Guelin, IRAM, Grenoble.)

In a supernova explosion in a dense medium, the kinetic energy of the explosion is thermalized and radiated in a pulse as, for instance, with SN1987F; the spectrum, the pulse shape and the total energy involved resembled the spectra and flares in the nucleus of Seyfert galaxies (R. Terlevich, RGO, Cambridge; G. Tenorio-Tagle, IAC, Canary Islands). A pulse of heated discussion followed the proposition that some galactic nuclei are not powered by black holes but by numerous individual supernovae exploding into a dense medium — that is, by a large collection of fire-crackers instead of one superbomb. □

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DAEDALUS

Wet blanket

LAST week Daedalus remarked that sodium ions are mobile both in liquid water and in solids like beta-alumina. In water they are hydrated; in beta-alumina they are not. So in passing from the liquid to the solid, they would dehydrate, thus liberating water. Emerging back into the liquid, they would take up water again.

Daedalus now wants to drive this process with sunlight. He points out that solar photons have energies in the ion-dehydration range. At a solid–liquid electrolyte junction, they could dehydrate the water-borne ions and promote their entry into the solid. Sadly, the most promising ions and electrolytes for this process are colourless. To capture light for chemical purposes, the junction would need to be doped by a photosensitizing dye. So, says Daedalus, take a semipermeable tube of liquid electrolyte, join it at both ends to a rod of solid electrolyte, dope one junction with a suitable dye, and stand the result in sunlight. At the doped junction, ions will go from liquid to solid, dehydrating in the process. The released water will exude from the junction. At the undoped junction, the ionic current will emerge into the liquid again, rehydrating and taking up water. In the absence of any other source, it would even extract it from the air.

The applications are obvious. It is precisely the sunniest regions of the world that find it hardest to obtain water. But even the driest desert air has lots of water in it, which can now be simply captured. Daedalus hopes to miniaturize his photovoltaic vapour-condenser into a simple hollow fibre, whose outside absorbs water-vapour from the air, and pumps it into the central channel. Woven into fabric and exposed to sunlight, DREADCO's 'Sundew' fabric will deliver a steady trickle of captured pure water from its fibre ends. For the first time in the history of human settlements, water supply will no longer be a problem.

A simple Sundew-fabric tent will meet the watery needs of the most isolated explorer, desert wanderer or shanty-town dweller. As panels in a greenhouse, Sundew will capture water from the air outside, as well as condensing and recycling the transpired vapour from the plants inside. Sundew clothing will absorb evaporated sweat, and recycle it as potable water. Woven into sails, it will effortlessly solve the marine water problem. The nightmare technology of modern hydraulic engineering, the dams and reservoirs and vast webs of leaky pipes, as well as the endless wretched trudging for dirty well and river water throughout the third world, will be mercifully obsolete.

David Jones