jets associated with them. Jet-cloud interactions can generate localized H-H objects in a variety of ways, ranging from the production of internal shocks in the jet to radiation behind the shock-wave systems at the front of the jet as it bores its way through the surrounding cloud. Considerable attention is currently being given to the production of H-H objects by jets that precess or in which the jet velocity varies. Curiously, how stars produce jets is an open question.

One of the earliest attempts to explain H-H objects was in terms of the motion of fast-moving 'bullets' of material through the molecular cloud³. The radiating gas — the H-H object — originates in shocked cloud gas behind the bow shock on the leading face of this cosmic missile. This model fell out of favour for numerous reasons. For example, the origin of the missile was far from clear; and as detailed structures of many H-H objects were elucidated, the jet interactions described above seemed a much better proposition. Allen and Burton now argue¹ that, at least as far as their observational data are concerned, the projectile model best fits the facts.

They note that the molecular hydrogen emission reveals long tail-like structures which project back to a more or less common origin in the vicinity of well-known stellar residents of the Orion molecular cloud (see cover photo). The ends of the tails furthest away from the 'origin' are not visible in molecular hydrogen but are bright in the light of forbidden transitions from singly ionized iron. This latter emission is a well-known indicator of shock activity for shock velocities of up to several hundred kilometres a second. Allen and Burton also point out that there are families of H-H objects in the Orion cloud that are bright in the forbidden lines of singly ionized oxygen^{4,5} and that all such knots have corresponding iron emission features. The oxygen lines, studied in detail, have spectral widths up to 400 km s⁻¹, which must indicate actual gas velocities of this magnitude⁵.

Allen and Burton propose the following model. A few thousand years ago, some violent explosive phenomenon occurred which hurled numerous bullets ('shrapnel') into the molecular cloud with velocities probably in excess of 400 km s⁻¹. The bullets swept up cloud material through the bow shocks on their leading faces, producing the iron and oxygen emission behind the shocks. The velocity widths of the lines will range roughly up to the bullets' speed. Molecular hydrogen is rather fragile (in interstellar terms), and is destroyed by shock waves with velocities greater than about 50 km s⁻¹ and cannot exist behind the leading shock. However, bow shocks become wrapped around blunt obstacles

and become much weaker the further away they are from the obstacle head. Molecular hydrogen could survive and be excited by passage through these extremely oblique shocks.

The origin of the bullets is obscure and a real understanding of their energetics is needed to pin it down. A rough estimate by the authors suggests that some scaled-up version of so-called FU Orionis events might be plausible. These are quite well-known occurrences in which stars of a certain class liberate a considerable amount of energy through an astrophysical trauma involving instabilities of the accretion disk. Alternatively, Allen and Burton note that a supernova would have enough kinetic energy to power the bullets, although there is certainly no other direct evidence for one having occurred in this region. On the positive side for such a picture, observations of (astrophysically) recent supernovae such as Cassiopeia A or even the Crab show that supernova explosions are extremely fragmented.

These various possibilities are extremely exciting, but a great deal of follow-up observation and modelling needs to be done. It is crucial to develop realistic shock models to see whether plausible parameters can be found which give the correct behaviour of the observed emission. It may perhaps be premature to jettison continuous wind interactions completely. Although Allen and Burton, probably correctly, discount the possibility of a collection of individual jets each powering a molecular hydrogen 'finger', excitation by a precessing jet may be plausible, though this depends on whether continuous emission can be maintained as the jet precesses. Recent work on sporadic jet outbursts by a precessing jet⁶ shows considerable promise for explaining families of H-H objects. Finally, there are puzzling aspects of the oxygen emission, notably that it is particularly strong at essentially zero velocity⁵. This is very hard to fit into a projectile model.

Whatever the resolution of these problems, Allen and Burton's observations show that many surprises are in store as modern observational techniques enable us to probe into hitherto unexplored regions of interstellar space. □

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Monopoly money

EVEN the most advanced modern economies cycle regularly between boom and slump. This reminds Daedalus of an ecology with relatively few interacting species. The populations of predators and prey both rise and fall violently. By contrast, a complex ecology with many different species shows a deep stability. Individual populations may still fluctuate, but the overall balance of the community remains steady.

What lack of diversity destabilizes an economy? Daedalus reckons it is the single currency. The EC's goal of a single currency is thus exactly wrong, as you might expect. Instead, it should achieve financial unification by making all its currencies legal tender in every member state.

The experiment would be highly instructive. The present national currencies are mutually well insulated. Their rates of exchange are quite artificial, being set by government interest-rate policies, and are easily exploited by parasitic speculators. But once pounds and deutschmarks and francs and lira were all competing against each other in every high street, their exchange rates would always reflect what each currency could actually buy. Even the biggest speculators could not distort them, or make much profit by doing so.

Ecological theory holds that no two species can occupy exactly the same niche. So Daedalus expects that the various currencies would diversify into different 'economic niches'. In doing so, they would highlight the various roles that money plays in society: a medium of exchange or of speculation, a store of value, and so on. One likely niche corresponds to the scavenger species in an ecosystem. This currency would dominate declining industries and regions (the British pound seems a natural candidate). By depreciating against the other currencies as needed, the scavenger currency would insulate them from this local depression. A society with n independent currencies should be $\sqrt{n}$ times as stable as one with a single currency.

Even better, governments could no longer cheat their citizens by inflation. At present, any government can simply print currency and spend it, enriching itself while impoverishing its citizens. But in a multicurrency society, the citizens could hedge away from such trickery. A currency that started inflating strongly would rapidly be abandoned for all purposes, except that of paying tax to the government printing it.

David Jones