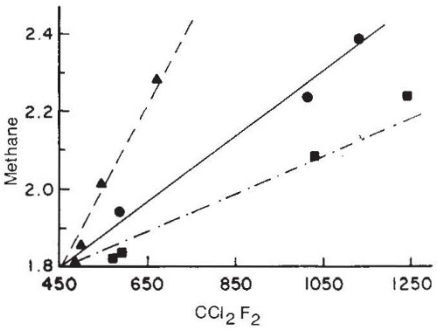
than those characteristic of most US cities, or of two other eastern European cities (Vienna and Zagreb). Because most other major global methane sources are biological and non-urban (such as rice, cattle or swamps)[4], leakage during natural-gas transmission is the most probable source of this excess urban methane. Furthermore, air samples collected from the Yerevan region of Armenia in January 1990 exhibited even higher concentrations of methane (3.3–3.5 parts per million per volume) and most other light hydrocarbon gases (0.02–0.1).

Although the excess methane concentrations in the European cities were clearly of local urban origin, the hydrocarbon concentrations 15 kilometres away from Yerevan were as large as those in the city itself, suggesting regional release over a broader area. At that time, industrial activity in Armenia was only about one-quarter of normal because of disruptions for transport.

Most chlorofluorocarbon gases are emitted directly into city air and are excellent markers of urban contamination



Correlations of measured urban concentrations of methane in parts per 10^6 with CCl_2F_2 in parts per 10^{12} in three cities. Squares, Budapest; circles, Prague; triangles, Krakow.

of an air mass[5]. The increase in methane concentrations versus those of CCl_2F_2 are shown in the figure for Budapest, Krakow and Prague. In each city, the incremental increase in methane is approximately proportional to that for CCl_2F_2, demonstrating the local urban origin for methane. The intercepts in the figure are consistent with the concentrations found in remote regions for these latitudes and season.

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Dynamical mass-transfer paradox

SIR—Although the periodically varying frequency of the emission lines of the star SS433 can be described kinematically[1] by two precessing jet sources emanating from one component of a binary system, many of its physical and dynamical properties remain enigmatic. In particular, the jet speed and power require a compact source whereas the precessional behaviour would be appropriate for a slowly rotating giant star. Here we summarize this dichotomy and speculate on a novel resolution of it.

The terminal speed v_∞ of stellar mass loss is characteristically of the order of the escape speed, so the value $v_\infty = 0.26\ c$ implies that SS433 is a neutron star or black hole. Further, only gravitational accretion onto a collapsed object suffices to power the jets (10^{39} erg s^{-1}). The thick supercritical keplerian disk required for accretion from the companion has been proposed[2] as providing jet collination and invoked to explain the observed[3] occultation of the X-ray jets within 10^{12} cm.

A keplerian disk, however, cannot as a whole undergo coherent driven precession, and it has been proposed[4] that the disk geometry is somehow 'slaved' by angular momentum of matter incident from the giant companion, which can precess coherently. This poses two problems. First, for the companion to provide the observed amplitude and phasing of the 'slave' precession pattern, it must be a slow rotator[5,6]. Proper analysis of this suggestion must include the orbital as well as the rotational angular momentum. Second, angular momentum transfer in the accretion stream takes at least the free-fall time (about 6 days) which is comparable[7] to the jet nodding period. Therefore, the jet axes move as if they emerged from the slow rotation axis of a giant star undergoing driven procession[5], though their speed and power require they originate from a collapsed object.

To reconcile this dichotomy, we conjecture that the jets emanate from a polar hole in a precessing giant star in whose core resides an accreting collapsed object which powers them. Such a hybrid object could form by rapid dynamical mass transfer from a giant before helium ignition[8] onto an already critically accreting collapsed object, the polar hole being blown by a pre-existing jet and sustained in the rotating giant star as described in ref. 9. We suggest first that mass expulsion from the central accretor will occur preferentially along the reduced overpressure direction of the hole and, second, that the hole will follow the driven precession of the hybrid. As regards the second suggestion, enough time has elapsed since the formation of SS433 for circulation to lead to uniform rotation of the hybrid and hence allow its entire structure to precess coherently[10,11]. In our picture, occultation of the X-ray jets[3] is caused by the hybrid itself (with a radius of about 10^{12} cm) rather than by a thick disk.

We believe our preliminary model has possible attractions beyond reconciling the jet speed and precession properties. For example, the stability of the radiation field in the funnel may explain the remarkable jet speed constancy. The model should also be amenable to predictive observational tests, including the eclipse effects of two large stars.

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Pebble shape

SIR—Based on his measurements of the proportions of the three principal diameters of beach pebbles, Wald in Scientific Correspondence[1] concluded that the shapes of pebbles evolve toward the stable form of a flattened ovoid due to abrasion by waves. In response, Ashcroft[2] attributed the flat shapes of beach pebbles to planar structures in the original rock material.

This fascination with pebble shapes has existed for more than 150 years. In 1834, Palmer[3] discussed the role of waves in sorting pebbles on the beach according to their sizes and shapes. Writing in 1898, Cornish[4] suggested the shapes and sizes of beach gravels are initially a product of the natural fragmentation of the original rock material, but abrasion by waves then modifies their shapes. In a paper published by *Nature* in 1944, Lord Rayleigh[5] reported his laboratory experiments simulating the abrasion of pebbles lacking internal planar structures. In those experiments, he could reproduce flattened disks very similar to those found on beaches.

More recent investigators have used