form very long cylindrical micelles[6]. Some organic polymers called 'living polymers' polymerize in equilibrium very suddenly[8,9]. In the physics of adsorbed layers some phenomena such as commensurate-incommensurate transitions[10] are driven by defect lines which behave like polymers in equilibrium.

Recently we have shown[11-13] that equilibirum polymerization can lead, if the initiation step is very difficult (very large free energy associated with the ends of the chains) to a quasi-second-order transition with a critical point fully analogous to the critical point of a ferromagnet in the presence of a very small magnetic field leading to a weak rounding of the transition. Thus, contrary to the statement of McIntosh, the condensation-polymerization model does present a phase transition very analogous to many other second-order phase transitions; in the limit of infinite free energy associated with the ends of the chains a true transition exists with the polymerization of very few infinitely long chains. Interestingly, the helix-coil transition[14] is a trivial example of equilibrium polymerization in one dimension[15] ($d = 1$) where helix portions are the 'polymers' and the 'coil' portions the unpolymerized 'monomers'. For this special low dimension case ($d = 1$) the transition becomes first order with a jump from all unpolymerized (coil) to all polymerized (helix). The effect of a non-infinite free energy of the extremities of the 'polymers' (frontier energy between helix and coil is not infinite) is to round the transition and to replace the first order jump by a sudden rise.

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Scientific Correspondence

Scientific Correspondence is intended to provide a forum in which readers may raise points of a rather technical character which are not provoked by articles or letters previously published (where Matters Arising remains appropriate).

Periodic comet showers and planet X

SIR — In our recent *Nature* paper we discussed a model in which periodic comet showers are triggered by the passage of the perihelion of planet X through the edge of a trans-Neptune comet disk (*Nature* **313**, 36-38; 1985). It was assumed that all scattered comets with perihelia less than Neptune's orbit that ultimately became Jupiter family SP comets would contribute to the shower. However, it has recently been brought to our attention that the time scale for Neptune and Uranus captured comets to evolve into Jupiter family SP comets is greater than the interval between showers so these comets cannot contribute to a shower of duration of a few Myr (R. Muller and P. Weismann, personal communications).

This objection does not invalidate the basic model, since sharp showers will still be produced by comets scattered directly into Jupiter's sphere of influence, as Jupiter family SP comets have dynamcial lifetimes $\lessapprox 1$ Myr. Direct scattering to Jupiter will require the inclination of the orbit of planet X to be $\gtrsim 45°$, which in turn will reduce the predicted semimajor axis of planet X from ~ 100 AU to $\lessapprox 75$ AU. The required large inclination is consistent with the failure of previous ecliptic surveys to find planet X. That fraction of Neptune-Uranus captured comets which ultimately end up as Jupiter family SP comets will contribute to (or perhaps dominate) the steady state background of SP comets. Preliminary estimates indicate that total numbers of shower and associated steady state SP comets are roughly comparable and that the requisite number of terrestrial impacts can be achieved.

A more extensive analysis of the planet X model taking into account the above modifications in the details of the shower mechanism, the effect of a thick comet disk on the shower time scale, and gap-diffusion driven by planet X, will be published elsewhere[1].

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The nomenclature of the heavy elements

SIR — Chemical elements, previously discovered in nature by chemists, in recent years have been artificially synthesized by nuclear physicists. Due to competition among chemists and controversy about the initial description of an element, some elements received two names, depending upon the country or chemist (for example beryllium or glucinium; niobium or columbium; wolfram or tungsten).

The International Union of Pure and Applied Chemistry (IUPAC) has given its Commission on Nomenclature of Inorganic Chemistry the task of recommending a name for a newly discovered chemical element. However, Commission members are not experts in nuclear physics. Of late, there have been conflicting claims to discovery of the trans-lawrencium elements, $Z \geqslant 104$. IPUAC's policy, as written in the book of Nomenclature of Inorganic Chemistry, is not to deny the right of a discoverer to propose a name.

Among the international guidelines to consider are: the name should differ as little as possible in different languages and it should be based on pragmatism and prevailing usage. Since usage is a major factor, IUPAC's choice carries no implication about priority of discovery, for example some names ($Z<92$) are not those originally proposed by the element's discoverer.

Meanwhile, theoreticians discuss the properties of undiscovered elements. Although elements do not receive common names before their discovery, names are needed for practicality, as well as for abstracting and retrieval purposes.

For these reasons only, the Nomenclature Commission proposed a system for naming any element with Z larger than 100 (*Pure appl. Chem.* **51**, 381; 1979). This is based upon the atomic number, with roots of 0 = nil, 1 = un, 2 = bi, 3 = tri, 4 = quad, 5 = pent, 6 = hex, 7 = sept, 8 = oct and 9 = enn. Thus, 104 = unnilquadium, 107 = unnilseptium, 114 = ununquadium, 126 = unbihexium with the equivalent symbols Unq, Uns, Uuq, Ubh.

This artificial system may look cumbersome and unnecessary for merely referencing the elements. The atomic number presently serves that purpose adequately. However, when discussions of chemical compounds involving these elements begin to appear in the literature, this system will become necessary for the names of compounds and their formulas.

One may always refer to an element by its number only. However, the optional system above provides an internationally accepted name.

Of course, once the claim of discovery of a new element and its proposed name is accepted by the scientific community, the Commission is ready to incorporate any name given by the discoverer.

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