

ON ORDER

Things which have perplexed you and made the case more obscure
have served to enlighten me and to strengthen my conclusions.

Arthur Conan Doyle (1887)

If the gravitational entropy ... increases with time then the initial
state of the universe was one of very low, or even zero, gravitational
entropy.

John Barrow (1994)

At the beginning of time, when temperatures were incredibly hot,
the universe must have been perfectly symmetrical.

Michio Kaku (1995)

The ultimate source of order, or low entropy, must be the Big Bang
itself.

Brian Greene (2005)

The arrow of time ... is not a feature of the underlying laws of
physics, at least as far as we know.

Sean Carroll (2010)

Some things never stop it seems. The rubber-concrete rumble of the 101. The surf off Margaret River beach. The everlasting Tocking of the Cosmic Clock. But even everlasting can be relative I guess. Physics says the universe is running down. What he can add is how it is a thing that *can* run down.

This too begins with the Beginning. It's about order. As any physicist will say, it must be; it is order that runs down. Or disorder runs up. It's no wonder that it's German physics that begins the scientific revolution. At bottom it is about order. Disorder drove Planck. And a Teutonic tang, an *Ordnung*, clings to his Beginning.

"It was perfect."

What a welcome sound! It's the first sign that I've had that he's awake—as I have come to think of it—this morning. He sounds self-satisfied. He means that the Beginning is a state of perfect order. I've read enough to know he may be right. He and I have seen how physicists are challenged to say how, in the first moments of the universe, its entropy could be so low. That is to say, its order was ridiculously high. Well, it seems to me that his Beginning *is* in perfect order. *Alles* is indeed in *Ordnung*. Neither greater *alles* nor more order is conceivable. One definition of the entropy of any system is a simple function (technically, the log or

natural logarithm) of how many different ways its bits can be arranged. The Beginning has just one configuration; it's the way it is. The log of one is zero. Entropy can go no lower. So there is no Problem of Perfection: At first there *is* perfection; the problem was that physicists could not conceive of it.

I'm feeling pretty pleased with this conclusion when it occurs to me this is the bow that shoots time's Arrow {xe "arrow of time"}. Entropy goes up from the Beginning; order must go down. At every Move the UC tries a little randomness. And thus the Second Law is born. That teenager is put in charge of everything.

It's not only low entropy that gets the physicists excited. So does high temperature. Most everybody knows that in the beginning the universe is infinitely hot. He hasn't said a word about it yet. Kaku says it ties to symmetry. He's saying that it was symmetrical *because* it was so hot. At first I thought of his Beginning as stone-cold but now I wonder: Does it *have* a temperature? And I'm troubled by the notion that this tiny ordered universe is loaded with an inconceivable amount of what will turn out to be mass-energy. At least that's what I think he thinks. I've gone along but it seems ugly. Is it *in* the Manifold? How can it be? And how can it *not* be? If neither in nor out, what does it mean? He doesn't answer questions.