# THE CURSE OF CONTINUITY

**The [usual convention] is the belief in continuity, a belief without which it would be difficult to justify apodeictic reasoning, but without which all science would be impossible.**

Henri Poincaré (1901)

**I consider it entirely possible that physics cannot be based upon … continuous structures. Then *nothing* will remain of my whole castle in the air including the theory of gravitation, but also nothing of the rest of contemporary physics.**

Albert Einstein (1954)

**I believe that the theory that space is continuous is wrong.**

Richard Feynman (1965)

**At present, physicists … search only for continuous pictures of fundamental physics. Maybe, one day, they will be motivated to look at possible structures of a fundamentally discrete world.**

John Barrow (2007)

What if space does come in pieces? I don't know the answer but today his question leads me on to continuity. I start with Poincaré. I recall apodeictic from Phil 101. Some say apodictic. Either way it means self-evident.

Poincaré's not saying continuity itself is apodictic. He calls it a convention. He means it's an assumption. He's saying without this assumption he won't know if anything is true.

He's saying too that continuity's the basis of all science. By science he means physics. By continuity he means a space that's infinitely smooth. Trout explains:

> First, space has certain topological properties. The most important of these is *continuity*; that is, space can be subdivided in such a way that every point has a 'neighborhood' that, no matter how many times it is subdivided or reduced, contains an infinite number of other points.

So, already, there's the rub! Which *is* what Shakespeare said. It's an odd image.

The rub in this case is my sense his mission may flush smooth space down the drain. Things could then get rough; as Barrow says, all physicists believe or at least use it. Why? Well, it's Newton who gives math its first foothold in physics. Calculus may be the most important of the many math devices he invents. Calculus gets physics going. It's based on space that's made of infinitely

many size-less points.

Some physicists are studying approaches without points in space. They assume that space itself is quantized, made of tiny pieces that can't be divided. It's not exactly popular. I find few papers on its physics. One reason could be that the math of space gets thrown out with its points. A PhD may take ten years to learn that math. Few volunteer to take the trip back to square one. But those who do have found enough to show that Poincaré is wrong. It's *not* impossible.

The Curse of Continuity is that it's only an assumption. As Einstein says in later life, it may be wrong.