Letters to the Editor

Atomic Bombs and Novae

A number of people—and they are not all nonscientists—are apparently somewhat disturbed over the prospect of an atomic bomb explosion detonating the whole earth and producing a nova. When those not versed in physics have raised the question with me, I have usually explained the packing effect, stability of nuclei, and have pointed out that, while the fission of uranium releases energy, the splitting of the two most abundant elements of the earth's crust, oxygen and silicon, would absorb energy. This usually satisfies or bewilders the inquirer.

But a few physicists have put the question this way: "Granted that all our experiments and theories are correct *so far as they go, and on the laboratory scale,* do they go far enough, and can we be confident that they apply on the scale of the proposed test, in which an atomic bomb is to be exploded in contact with the surface of the ocean?" The question is naturally followed by another: "Do we know that the novae we observe out in space are not actually planets whose physicists have carried nuclear research just a little too far?" Not being a nuclear physicist, I can't answer the first question; as a student of the novae, I believe I can give a partial answer to the second.

The novae are definitely *stars*—that is, self-luminous bodies of gas with dimensions that greatly exceed those of the earth. More than a score of novae were recorded on photographs before their great explosive outbursts. After the explosions were over, the stars quieted down and assumed again (in every case for which the record is adequate) a brightness that agreed with the prenova magnitude very closely, if not exactly. Four examples of recurrent outbursts at intervals of a number of years are known. One of these stars at minimum was too faint to appear on the older photographs, but the other three show no appreciable change from one intereruption stage to the next. The explosion is evidently relatively superficial and produces no appreciable permanent alteration of the star.

Except for the recurrent novae and one other (Nova Aquilae 1918), more intimate observations of the prenova stars are not available, but the postnova stars have been well observed in about a score of cases. They are all of a perfectly distinct and unmistakable type, quite unlike "normal" stars (such as the sun). Their total brightness is similar to that of the sun, on the average, but they are much smaller than it and have much higher temperatures. Their densities must be from 100 to 1,000 times that of water; they are "subdwarfs," intermediate between "normal" stars and the very dense and small "white dwarfs."

Observations of the spectrum of a nova in the quieting-down stages of the eruption indicate pretty clearly that the outburst originated in the star and not in a satellite of it. The scale of the explosion is vast; the luminosity exceeds that of the star at its normal minimum for at least a few years, and the amount of matter erupted is in the neighborhood of 100 times the mass of the earth. Thus, a giant planet would be required, though it should be possible to observe a similar explosion of an earth-like mass if one occurred. The fact that several novae have continued to vary for many years, and that a few were variable before the outburst, is similarly definite evidence of the stellar nature of the explosion. It would be quite remarkable if every one of the too-inquisitive planets were associated with the same very peculiar type of star. And the fact of recurrence is similarly irreconcilable with the suggestion of a planetary accident.

Thus, the well-observed novae are quite conclusively in disagreement with the planetary explosion hypothesis, and no other observation supports it. But of course there are a number of novae for which the observational record is so sketchy that we can only say they do not contradict the preceding statements. If the suggested catastrophe were to be admitted as a physical possibility, then I could not deny that among the *most imperfectly observed* novae some might have been produced in that way.

The above statements are not made in defense of the atomic bomb tests, but simply in answer to a question that has been raised privately enough times to make a public answer appear in order.

DEAN B. MCLAUGHLIN
Observatory of the University of Michigan

Facts, Feelings, and Freedom of Science

In his reply (*Science*, 1946, **103**, 404) to our letter, "Freedom of science in the Soviet Union" (*Science*, 1946, **103**, 281), Sergei Gaposchkin, of the Harvard College Observatory, accuses that our letter "does not contain facts but only feelings."

We presented at least three facts: (1) the nonexistence of freedom of science in the Soviet Union, (2) the imprisonment and death in a concentration camp of N. I. Vavilov, and (3) the imprisonment of many other scientists in the Soviet concentration camps. We are also sure that Dr. Gaposchkin, as an astronomer, knows about the purge of Soviet astronomers in which some prominent scientists were liquidated (see R. Simpson. *Sat. Rev. Lit.*, 30 March, p. 30). But he ignores all these facts, calling them feelings, and then indulges in an emotional outburst.

What bearing on the freedom of science has, for instance, the very regrettable fact of huge Soviet losses in the last war? The Soviet Government used to imprison and execute scientists many years before the war and continues to do so. The statement that the lives of 130,000,000 Americans were saved by the Russians not only has not even the slightest connection with the subject raised by us but is very controversial, because many Americans think that the United States saved the Soviet Union. We believe the proper place to discuss all these questions injected into controversy by our opponent is