for many years taken an active part in the administration of the Association.

Prof. Henry Norris Russell, Princeton University astronomer, who was elected president will preside at the Boston meeting during Christmas week 1933 and deliver the principal address of the 1934 meeting as retiring president.

Dr. Burton E. Livingston of Johns Hopkins University who for many years was permanent secretary, was reelected general secretary and John L. Wirt of the Carnegie Institution of Washington was reelected treasurer. Dr. Livingston was also nominated as representative of the A. A. A. S., on the board of trustees of Science Service.

Science News Letter, January 7, 1933

SEISMOLOGY

Catastrophic Earthquake Rocks Interior of China

CHRISTMAS brought to the isolated interior of China a very severe earthquake that was probably extremely destructive to life and property.

From reports wired Science Service by eight seismological observatories in different parts of the world, the U. S. Coast and Geodetic Survey determined that the shock occurred Saturday, December 24, 9:04.5 p. m., Eastern Standard Time at 38 degrees north latitude, 96½ degrees east longitude. This location is near Tsaidam Swamp.

It is likely that news of the probable disaster will not reach the outside world for several weeks.

Science News Letter, January 7, 1933

COSMOGONY

Beginning and End to Universe May Fall Before New Physics

Prof. Tolman Pictures Infinite Life in Past and Future Instead of Universe Eventually Dying of "Heat Death"

SCIENCE and mankind are relieved of the necessity of considering that they live in a universe that was created at a definite time in the past or fated for stagnation and death in the future, if new principles of relativity and thermodynamics developed by Prof. Richard C. Tolman, California Institute of Technology "universe maker", stand the test of future discoveries.

Delivering the Josiah Willard Gibbs lecture before the American Association for the Advancement of Science, Prof. Tolman, who is a world authority on thermodynamics or the science of heat-energy and motion, extended thermodynamics to Einstein's special and general theories of relativity.

He arrived at findings that promise to have profound influence on philosophy and even religion as well as on science.

Now Expanding

Old-fashioned, classical science viewed the universe as running down in energy like a clock, eventually dying a "heat-death" when all heat and energy arrives at a dead level. Prof. Tolman's greatly simplified cosmological models hold the hope that under the new relativistic thermodynamics the universe can forever and ever experience a succession of irreversible expansions and contractions.

This fits in with the astronomical observations that we live in a rapidly expanding universe in which the great stellar galaxies are rushing away from us at speeds of thousands of miles a second. Prof. Tolman's tentative idea of the universe explains how it is possible that it is now expanding, that it previously contracted, that it will contract in the future and that this cycle will continue unendingly.

A creation or beginning of the universe is necessary under our ordinary, every-day, classical ideas. Prof. Tolman's marrying of thermodynamics with relativity may have removed the necessity of thinking of the universe having a beginning. In the "cautious position" to which he is taken by his mathematics and physics: "we no longer dogmatically assert that the principles of thermodynamics necessarily require a universe created at a finite time in the past."

Gibbs was the great American scientist who gave the classical principles of thermodynamics their most complete and comprehensive expression. Delivering a memorial lecture named in Gibbs' honor, Prof. Tolman told why it has become necessary to extend the classical thermodynamical principles to relativity that has so greatly influenced all science in the last two decades.

Classical thermodynamics was developed with the assumption that the things about him were at rest with respect to the observer. Prof. Tolman found it necessary to develop thermodynamics for observers in uniform relative motion to each other as is the case in the Einstein special theory of relativity.

The old-fashioned thermodynamics applied to space and time that had limited range and lacked strong gravitational fields. Prof. Tolman found it necessary therefore to extend thermodynamics to Einstein's general relativity in order to consider the heat-energy behavior of large portions of the universe. The older ideas of heat and energy needed refining in just the same way that Einstein found it necessary to develop a theory of gravitation that is more precise than Newton's.

Ordinary Principle Fails

Prof. Tolman detailed the technical modifications in thermodynamic theory needed to extend it to relativity and then gave examples of its "essential novelty and the inherent rationality of its consequences."

One strange consequence is that a system in which there is heat equilibrium will have higher temperatures where the gravitational field is stronger, although in classical thermo- (*Turn to page* 12)