GENERAL SCIENCE

# Galaxy of Scientific Stars Give Their Views at Harvard

## Taking Part in Great Tercentenary Celebration, Leaders in Many Fields Address Notable Gathering

*Harvard University's Tercentenary Celebration now in progress has brought to Cambridge a group of about 70 of the world's most distinguished scientists from many lands. When the Puritans established a college at Newetowne in 1636, it was the birth of higher education in this country. The intellectual fête commemorating this beginning is reported in some of its highlights by the following articles.*

PHYSICS

## Sir Arthur Eddington— Relativity Too Artificial

IN HIS own characteristic way Sir Arthur Eddington, noted British astronomer from Cambridge University, England, mildly chided both relativity theory and the quantum theory for artificiality in his address at the Tercentenary Celebration of Harvard University.

Speaking on "The Cosmical Constant and the Recession of the Nebulae," Sir Arthur set up a simple ideal problem in cosmology and attempted to solve it by mathematical attack on the large, or macroscopic scale through relativity and also on the small or microscopic scale through quantum theory.

His intent in doing this, he indicated, was to find some link in meaning between the important constants "K" of gravitation and the cosmical constant "lambda" in the relativity theory, and the equally important constants of quantum theory—Planck's constant "h" and the other microscopic constants.

The two answers to his hypothetical problem linking relativity and quantum theory, he said, must agree and should disclose hitherto unrecognized relations between the mutual constants.

### Inherent Artificialities

Both quantum theory and relativity theory, Sir Arthur disclosed, have inherent artificialities which make the problem difficult. For example, Sir Arthur said, "We had to catechize the quantum physicist, who writes down a wave equation for two or three particles, as to what he had done with the rest of the universe. Similarly when the cosmologist treats the curvature of a vacuum (in relativity theory) we have to ask what he has done with the particles removed."

The ideal problem proposed by Sir Arthur for solution was to find the state of equilibrium of a radiationless, self-contained system of a very large number of particles, both positive and negative.

First step in the solution, said the British astronomer, is to obtain the projection of the spherical Einstein universe into a flat space. A spherical space of uniform density throughout, he disclosed, becomes, after projection, a flat sheet with a density distribution concentrated toward the center and fading off to zero at infinity. This distribution resembles the distribution of electron density in the atom of the physicist.

Without following the details of Sir Arthur's mathematics it can be explained that he arrives at a value for the number of particles in his idealized universe problem which he calls a "deputy cosmical constant." To distinguish it from the important cosmical constant lambda, Sir Arthur calls it the "cosmical number."

### "Precisely"

"I feel satisfied," declared Eddington, "that the cosmical number is precisely $2 \cdot 136 \cdot 2^{256}$. The number of particles in this Eddington universe would total 2 multiplied by itself 255 times and then multiplied by 272."

From his mathematics Sir Arthur was also able to calculate the limiting maximum speed of recession of the distant nebulae which checks fairly well with observed measurements on the expansion of the universe.

The limiting speed, he declared, is 432 kilometers per second per megaparsec. The first part, 432 kilometers per second is, of course, a velocity amounting to 268 miles a second, or 964,800 miles an hour. A parsec is an astronomical unit of distance equal to 3.26 light years or about 20,000,000,000,000 miles. And a megaparsec is a million parsecs.

What Sir Arthur is saying, therefore, is that for every 20,000,000,000,000,000,000 miles one goes out into space the velocity of recession of the nebulae increases by 964,800 miles an hour.

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PHYSIOLOGY

## Prof. Edgar Douglas Adrian— Man Needs Bigger Brain

IF MAN'S life is ever to be lived along entirely rational lines, free from such disturbances as war, crime, and economic booms and depressions, he will have to find a way of increasing the size of his brain.

This is the conclusion to be drawn from what Prof. Edgar Douglas Adrian of Cambridge University, English Nobel laureate and one of the pioneers in "brain wave" investigations, told scientists at the Harvard Tercentenary Celebration of the relation between the nervous system and human behavior.

Scientific delvings into the mechanism of the mind and body, by "brain waves" and other techniques, show that the only certain method by which human behavior can be improved is the apparently impossible feat of breeding men with larger brains.

### Tantalizing

"It is tantalizing," Prof. Adrian said, "to think of the new relations we should see, of the new world of thought we should live in, if our brains were but twice their present size. Our behavior would then be superhuman!"

Not even the most fanciful mind, given to picturing a race of supermen in a world to come, could conceive of the result, which Prof. Adrian described as "beyond the power of human thought."

It is unlikely, he said, that neurology, study of the brain and nervous system, will give new methods of control over human behavior, though it will certainly improve some of the methods that already exist, such as the control of behavior by drugs. The new narcotics which "give peace of mind before a surgical operation" show what may be expected in the future from this method of regulating our brains and controlling our behavior.

Studies of the electrical activity that accompanies brain activity, the so-called brain waves, may show what takes place in the brain during the learning process, when new associations are formed in the brain, and why an incentive of an emotional sort is necessary to this proc-