

thing it should end the fears of those who encounter bats in dark rooms that the animals will strike them.

A normal bat will usually perceive and avoid an intruder by means of its sound echoes but even if a clumsy bat should alight on a person's hair, it does not become entangled, it has been found, but quickly extricates itself.

Scientists have suspected for some time that bats use their ears to guide them but this had never definitely been proved. The experiments just reported not only showed that hearing is essential for blind-flying but also gave the first proof that the apparently noiseless flight of a bat is actually accompanied by a clamor of shrill cries which the unaided human ear cannot hear.

To study these sounds the experimenters used apparatus which Prof. G. W. Pierce of Harvard's Cruft laboratory of physics developed for supersonic research. It revealed that the bat cries were loudest at 50,000 vibrations per second. This is well beyond the range of the human ear which even under favorable circumstances can rarely detect sounds with more than 20,000 vibrations a second.

Actually, bats are not blind, the Harvard biologists found, but their supersonic blind-flying system is so good they do not need to see. To prove that the sounds were required for blind-flying, the ears of bats were covered to prevent hearing and their mouths were covered to prevent them from uttering sounds.

Such animals when set free in a room hung with wires blundered helplessly into them. Yet as soon as the coverings were removed, the same bats flew skillfully and neatly avoided the wires.

On the other hand, bats fly as well with their eyes covered as they do with them open, provided the mouth and ears are uncovered. In reporting the research, the two biologists emphasized that the theory that bats were warned of the nearness of obstacles by a very delicate sense of touch in their wings, repeatedly disproved before this, but still heard occasionally, was wrong.

The supersonic cries, when translated into sounds the human ear can hear, sound like the rattle of distant machine-gun fire. Bats utter these cries at the rate of about 25 a second when flying in unobstructed space, raising the rate to about 50 a second when approaching an obstacle.

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Chocolate becomes *cocoa* when its fat content is less than 50%.

ASTRONOMY

Astronomer Suggests Search For Ghosts of Universe

Advances Theory That Supernovae After Explosion Become So Dense Any Light They Emit Could Not Leave

ASTRONOMERS may soon be searching for ghosts if a suggestion made recently is followed.

These are ghosts of the universe, tiny images of all the stars beyond one of extremely high density. They may be produced as the star bends light rays going past in a manner comparable to the way that a camera lens bends light rays from a scene and focusses them to form a picture on the film.

Speaking before the American Physical Society, Dr. Fritz Zwicky, of the California Institute of Technology, said that such images would afford a check of his theory of the ultimate fate of the gigantic star explosions called supernovae. When one occurs, a previously inconspicuous star suddenly rises to equal a hundred million suns in brilliance.

After such an explosion, which occurs on the average only once in several centuries in any one galaxy, such as our own Milky Way system, the end result is a collapsed neutron star, according to the Zwicky theory. This would represent the lowest states of energy that matter could possess without actually turning into radiation.

Because they would be so exceedingly dense, far surpassing even the "white dwarf" stars in which a cubic inch of matter might weigh millions of pounds, they could not be seen. The force of gravity would be so great that any light they might emit would not be able to get away.

That there is an effect of gravity on light was one of the predictions of the theory of relativity of Prof. Einstein. It has been confirmed by observations of the sun, where the effect is so slight that very delicate measurements are required to detect it.

With the neutron stars so dense, light from a distant star of the normal kind passing near one would be bent through a large angle, as if through a prism, Dr. Zwicky proposes. Where the light rays that have passed all parts of the edge of the neutron star meet, an image would be formed, so the star would really act as a gravitational lens. The image would

be seen, if at all, floating in space, between us and the neutron star. Images of other stars would also be formed, so, within a small ring, there would appear, he said, "a miniature edition of all the unobscured luminous objects in the universe."

If the neutron star is close enough, and in the right position, this image might be observed, Dr. Zwicky declared, suggesting that astronomers search for such images. Even if the details could not be seen, an analysis of the light from this ghost image might reveal its character, for the spectrum would be a combination of the spectra of many different kinds of stars.

"If the neutron star theory of supernovae is correct," said the speaker, "the number of collapsed stellar remnants of supernovae in our galaxy would exceed one million, and several collapsed neutron stars may be expected within a sphere of ten light years."

Less than ten visible stars are now known to be within this distance.

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PALEONTOLOGY

Find Dinosaur Neck Bone Nearly Four Feet Long

NOBODY could have complained about getting a piece of the neck, if there had been anyone around to make a holiday turkey out of a dinosaur whose fragmentary remains have been brought back to the American Museum of Natural History by Barnum Brown, recently returned after a season of field work in the Big Bend country of Texas. A single vertebra, or neck joint bone, is three feet across, only two inches less than four feet long, and in its present fossilized state weighs 600 pounds.

For stuffing, there could have been shellfish on the same scale. The party found oyster shells six inches wide and fourteen long, and there was one clamshell forty inches in diameter.

Dr. Brown, with his companions Dr. Erich M. Schlaikjer of Brooklyn College