semble the shell lines of an A star, a type which has much hydrogen in its make-up.

The giant G-type star, which ejects the stream of gas, is believed to be larger than the luminous A-type star. The relative masses of the two, however, have not as yet been determined. The A star is completely eclipsed once every 36.567 days, giving a chance to study the G star directly. But the streams of gas from the G star are projected upon the disk of the bright A star, so that a clear view of it is never realized for study.

That SX Cassiopeiae was not just a simple system of two eclipsing stars was discovered by Mme. L. Ceraski at Moscow in 1907. Peculiar variations in the star's velocity curve were observed by A. H. Joy at Mount Wilson Observatory. These, Dr. Struve believes, are probably due to changes in the density of the gas within the streams.

"The entire picture is very similar to that observed in Beta Lyrae," he states, "only here the smaller, and probably less massive star, is the bright A-type component."

Science News Letter, February 12, 1944

HUMAN GUINEA PIGS—In laboratory rooms simulating all kinds of weather — arctic blizzards, tropical rains, searing desert heats—various kinds of clothing for soldiers are tested by the U.S. Army Quartermaster Corps. Under the piece of clothing being tested, the volunteer wears an electronic contact harness, like the one on the man to the right, which constantly checks the temperatures of eight vital parts of his body.

PHYSICS

"Topography" of Crystals

Surface irregularities which are only a few molecules in depth are revealed by new photographic technique, in which two surfaces are silvered.

➤ THE UPS and downs, that is the topography, of an apparently flat crystal surface are revealed with startling clearness and highly increased accuracy by a new photographic technique making use of the interference of light. Differences in level as small as 1/5,000,000 inch, a step only a few molecules in height, can be detected.

The new technique is the work of S. Tolansky of the physics department of the University of Manchester, England, and is described in the British scientific journal, *Nature*. (Dec. 18, 1943)

An optical flat of high precision is brought very close to the crystal surface to be investigated. Such a flat is a piece of glass one surface of which has been ground and polished until it is as nearly as possible a perfectly plane surface. Both the surface of the crystal and that of the flat have been coated previously with a thin semi-transparent layer of silver, electrically deposited in a vacuum. The surfaces are then illuminated with the green light from a mercury arc lamp. This light is monochromatic—consists of only one wavelength.

The surfaces, as seen by the light reflected from them, do not appear of a uniform green tint. Instead, a pattern of light and dark bands appears. These are known as interference fringes, and are due to the alternate interference and reinforcement of light. In some places the light reflected from the surface of the crystal, the farther surface, combines with the light reflected from the optical flat, the nearer surface, in such a way that the crests of one wave stream fall into the troughs of the other wave stream. This is interference. They annul each other and a dark band results.

Nearby, on either side, where the distance between the two surfaces is greater or less by one-half wavelength of the light used, the two reflected rays combine crest to crest, and a bright band results. The iridescent colors of very thin films, such as those shown by an oil spot on the pavement, are similarly due to the interference of light reflected from the upper and lower surfaces of the film.

Assuming the glass surface to be perfectly flat, the interference fringes thus show the ups and downs of the crystal surface. They are the contour lines of a topographical map of the surface, the distance from one bright fringe to the next corresponding to a change in level of one wavelength of the light used. For the green mercury light, this is about 1/50,000 inch.

This interference method has long been used for the testing of flat surfaces. What is new in the present technique is the silvering of the two surfaces—apparently a very small change, but it makes a whale of a difference.

Without the silvering, the fringes are broad and hazy, and it is impossible to measure from the estimated center of one fringe to that of the next with any great accuracy. With the silvering, the bright fringes are reduced to thin sharp lines with wide dark spaces between them, just like the thin sharp lines used on any topographical map. Measurement is easy and accurate.

By silvering the surfaces, their reflecting powers are increased to the extent that 85% of the light is reflected, only 15% transmitted. The consequence is that the light is reflected back and forth between the two surfaces many times before it emerges, and interference predominates over reinforcement.

Examined by the new method, the surface of mica is seen to consist of rounded humps and hollows. The contour lines are smooth and rounded like those of a sand dune country. The surface of selenite, on the other hand, is seen to consist of ragged ridges all running in the same general direction, resembling a plowed field.

A very important use of the new method is to disclose the cleavage lines on a crystal surface. These are abrupt steps, tiny nearly vertical cliffs, like the much larger cliffs that geologists call