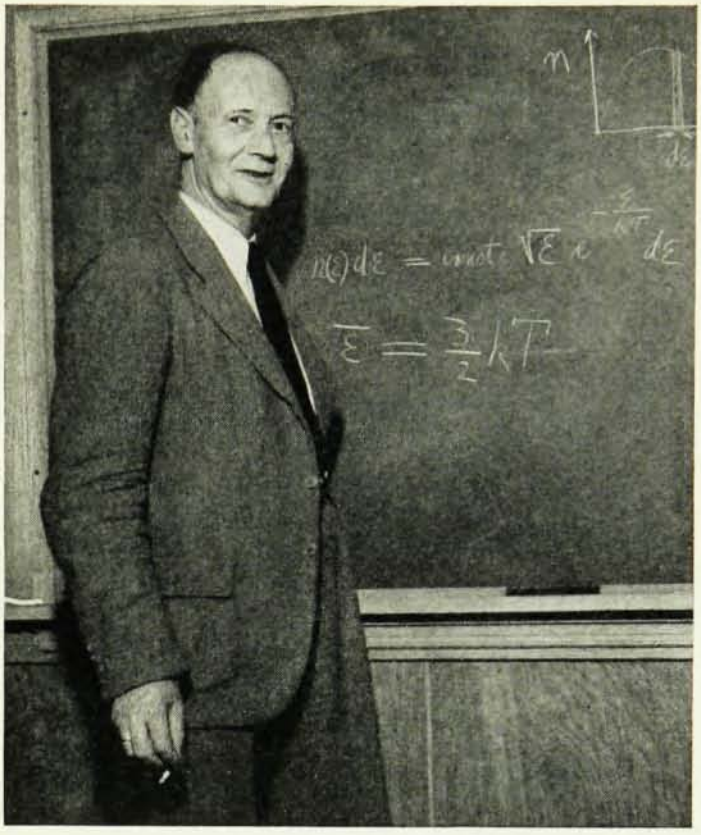

Richard Becker, professor of theoretical physics at the University of Göttingen, is a visiting professor this year at the Carnegie Institute of Technology, where he is taking part in a program of research in magnetism and low-temperature phenomena. Photo by J. W. Smith.

Research by the Carnegie Institute of Technology's physics department covers practically all parts of the field from liquid helium studies to meson production with a cyclotron. This article reviews the department's current activities.

Physics at Carnegie Tech

By ***Louise R. Smoluchowski***

"It is a terrible institution, this American cocktail party," Professor Richard Becker said recently. "Everyone crowds into a hot, smoky room where it is impossible to listen to each other speak. There are never enough chairs. In Europe there is a chair for every guest. And here no one leaves at the end of the party. A party should have an ending." Professor Becker does not pretend that he enjoys cocktail parties. He will, however, comment more kindly upon the lunches at the Faculty Club at the Carnegie Institute of Technology where he is completing a one year's visiting professorship on leave of absence from Göttingen University. Here you can find him during the noon hour (or hours) with his colleagues from the physics department and there is a chair for everyone and the conversation is definitely listened to.

Becker will smoke his cigarette and wander from table to table to savor the various "shop talks" or he will tell something himself of his work on the problems of liquid helium or the Kundt's tube apparatus he is trying to set up using solid hydrogen and deuterium instead of cork dust with which he hopes to observe nodes and antinodes of second sound standing waves; or he will talk of his work in the solid state (particularly magnetism) which is of special interest to physicists at Tech.

And what have Becker's colleagues to say of their work? Perhaps Gian-Carlo Wick, Lincoln Wolfenstein,

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Louise Riggs Smoluchowski devoted two of the most recent years of her life to editorial work on the staff of *Physics Today*. She was married early this year to Roman Smoluchowski, professor of physics at Carnegie Tech.

Julius Ashkin, and Herbert Corben will discuss quantum electrodynamics. If Bert Corben is not telling Australian jokes ("You know what a bison is? It's what an Austrylian washes his fyce in!") he is probably talking about his new theory on the nature of elementary particles. In his application of the unified field theory to nuclei and his search for gravito-electromagnetic effects, he has suggested the possibility that a photon may become charged when it nears a nucleus, and that systems of photons with properties vaguely similar to mesons are radiated in nucleon-nucleon collisions. Wick, who came to Carnegie in February of 1951, is working on quantum-electrodynamics and meson theory, and will talk about his efforts to simplify calculations of meson-nucleon interactions. Wolfenstein has completed his theory explaining angular distribution of nuclear reactions and is now working with Ashkin on polarization effects accompanying neutron-proton scattering.

But talking shop among the physics department members is by no means limited to theoreticians. There is Arnold Clark to tell of his photographic plate observations of stars produced from cosmic ray neutrons. He is designing an apparatus to keep the plates oriented in the earth's magnetic field. And Emerson Pugh, a member of the solid state group, is observing Hall effect in ferromagnetic materials. For these observations, which he makes at low temperatures, the materials must be saturated and thus a large magnet of some 40,000 gauss is necessary. Pugh is well known for his work on shaped charges which give bazooka projectiles their punch. Jack Goldman (another story teller but most of them unpublishable) is looking for very small effects in volume magnetostriction, work that he feels is important and basic for theory.

Certainly the biggest gadget of which Tech's physics department can talk is the synchrocyclotron at the Nuclear Research Center in nearby Saxonburg. This is the special charge of Edward Creutz, the genial head of the department. With the particular help of Martyn Foss, Roger Sutton, and John Fox he is adding the "finishing touches" that are yet to be put on the cyclotron. Although not the largest in size, the Saxonburg cyclotron has an unusually high magnetic field of 20,000 gauss and will be able to produce protons of about 440 Mev. The dee and high-frequency system are at present being installed and adjustments are being made to the rotating condenser. The radio-frequency oscillator is being set to operate in the range of 20 to 32 megacycles, which is the band width required to take care of the relativistic variation of the mass of the proton when accelerated.

In order to obtain the maximum diameter of usable magnetic field in the cyclotron, the edges of the pole pieces have several concentric grooves up to four inches deep. These grooves extend the useful field to about 96½ percent of the pole-tip diameter.

It is hoped to produce pi-mesons and one of the first engineering goals will be a beam of pi-mesons free from protons and neutrons. This should facilitate the study of meson interactions with matter as well as the study of interactions of nuclear particles to produce mesons.

Particular attention is directed toward devices to measure very short times, such as that necessary for light to travel a path of one inch. This work on short time measurement is largely done by Serge De Benedetti, who is preparing methods for the detection of mesons.

Among the laboratory work now in progress at Saxonburg is the search for positrons and electrons decaying from the triplet state of positronium into three gamma rays; low-temperature work on solids for which there is a Collins cryostat which produces five liters of liquid helium per hour; construction of a large double-focussing beta ray spectrograph; and the measurement by coincidence circuits of the lifetime of a positron in a metal before it meets an electron, of the angle between two gamma rays emitted by a positron upon annihilation, and of the coincidence between low energy alpha particles and the resulting gamma rays in polonium. There is a hot laboratory with walls made entirely of magnetite and cement and water to obtain a density of 200 lbs. per cubic foot. It is designed to handle up to 1 curie of radioactive material.

An interesting instrument in Tech's physics department is a cloud chamber which very soon will operate in a field of 19,000 gauss without the use of iron. This will be achieved by shorting a mine-sweeping generator across the cloud chamber coils.

Some physics research going on at Tech with a psychological twist is that of Charles Williamson, who is particularly interested in intonation in music. It is his belief that a musician, say a violinist, plays his part of a quartet differently, depending on whether he is playing alone or with the quartet. For comparing these performances he has devised instruments which record each of the musical instruments in a quartet individually.

To cover the work being done in the physics department and thus the shop that can be talked at Faculty Club lunches, one should describe the experiments being done by Immanual Estermann's students on liquid helium and semiconductors (Estermann is at present in Washington with the Office of Naval Research), William Bessey's study of the electrical and magnetic properties of metal films only a few molecules thick, Felix Adler's work on scattering and on the conservation of angular momentum in molecular collisions, Lloyd Smith's on pseudo-scalar and vector meson theory, Roman Smoluchowski who (besides his study of diffusion in the Metals Research Laboratory) is now working in the theory of magnetism and on crystal lattice imperfections, Walter Kohn's efforts to simplify ordinary perturbation theory to calculate matrix elements which occur in the theory of solids (he is now on leave in Copenhagen), and William Leivo's search for very small changes in the density of crystals due to plastic deformation, or darkening of ionic crystals upon x-ray irradiation.

But to tell details concerning all the work in progress would involve an endless story and we believe that stories, like cocktail parties, should have an ending.