3. Mr. G. Stetter (Vienna): Electron conduction caused by corpuscular rays in crystals. (Based on experiments by J. Kosmata and K. Huber.)

Similar to the phenomena known from the internal photoelectric effect, a "corpuscular electric" conduction would be expected when crystals were irradiated with corpuscular rays. The spatial distribution of the primarily formed ions differs from photoelectric excitation. As a result of the column ionization, a stronger reunification is to be expected, probably also with a local accumulation of defects. Furthermore, especially in the case of heavier particles with a relatively short range, the ion cloud is concentrated in a surface layer, which results in the occurrence of space charge effects even at low intensities. On the other hand, the use of corpuscular ionization can be advantageous in the investigation of crystals, in that the spatially well-defined corpuscular beam scans different areas like a probe.

First and foremost, the negative part of the primary current (as the Göttingen school called it), which is remarkable for its inert use, should be observed. At the same time, this would result in measuring evidence of individual corpuscular rays (crystal as ionization chamber). Furthermore, this also gives the possibility of clearly separating the desired effect* from polarization currents (probably mainly space charge polarization). Larger amounts of radiation destroy the crystal very quickly.

Experiments with a large number of different crystals: NaCl, KCl, KBr (partly made available by Prof. Pohl in a grateful manner), cerussite, fluorspar, sulphur, zinc blende, diamond, initially showed that it was obviously one of the rare crystals , lucky breaks when a yield of order 1 is achieved. A few powers of ten are usually missing. That this was not due to the primary ionization was proven by extensive photoelectric comparison tests. Nevertheless, integral effects (electrometric) could be observed; the values corresponded approximately to the photoelectric yields, increasing slightly with decreasing ionic density, i.e. in the following order: α-rays from polonium, from thorium C, short H rays, long H rays, β-rays.

With the guidance of the photoelectric investigation and the integral measurement, two diamond chips were finally found with a good yield. With these, using the short-term tube electrometer, a search was again made for individual effects, with the following surprising results: the loop oscillograph shows, within its resolution capability (0.001 sec), completely sharp deflections, which must therefore come from intermittent electron conduction, or at most an equivalent electron conduction, which is the number of deflections but only a fraction of the irradiated α-particles, the individual values are sometimes much too high and inhomogeneous. Furthermore, a comparative test with irradiation once on the negative electrode and the other time on the positive electrode gives about the same effect, while taking into account the influence, a ratio of 20:1 must be expected (with the given dimensions). The mechanism must therefore be quite different, and the individual impacts are interpreted as breakthroughs in a double layer occurring at the electrodes. In contrast to photoelectric conduction, which essentially takes place in the interior of the crystal, it is not a question here of induction, but of a real current transfer; the decisive factor is the crystal-electrode interface and probably the surface layer of the crystal with its structure, which is certainly different from the inside. These processes must also be decisive for the initiation of the electrical breakdown (thickness dependence of the breakdown field strength). However, the inconsistency of older integral measurements on corpuscularly irradiated crystals can be explained by the fact that the purity, in particular the structural purity of the test specimens was not taken into account.

Experiments with corpuscular ionization inside the crystal are planned.