formation about the nature of the particles.

After Dr. Judek emigrated to Canada in 1953, she applied this approach to the study of cosmic rays — high energy elementary particles and electromagnetic radiation which bombard the earth from outer space. Judek's experiments, part of a larger NRC program on cosmic rays, involved sending stacks of photographic plates into the upper atmosphere by balloon. At high altitudes the incoming cosmic rays would leave evidence of their nature on the photographic plates.

Back in the laboratory, each plate went through a photographic development process and was examined for a tracery of lines — the records of paths taken by energetic particles. In a typical "event" a cosmic ray, called a "primary", moving close to the speed of light, collides with a target nucleus in the emulsion. The impact loosens the forces that bind the neutrons and protons of the nucleus, fragmenting both the projectile and the target. The resulting "star", easily identified and measured under a microscope, represents the exploding fragments of this disintegration. The target fragments usually blow out sideways at large angles, while the pieces from the projectile nucleus deflect only slightly from their original path, carrying most of their energy forward as "secondaries". The tracks of these secondaries can then be followed through the plates until they collide again or leave the stack.

In one event after another, Dr. Judek saw the same familiar pattern. An initial star followed by the tracks of the secondaries. These latter paths would be marked by additional collisions, or stars, every 10 cm or so on average from the initial star. But, in 1965 during one of these investigations of cosmic ray fragments, Judek noticed that an unusually high number of the projectile fragments collided again after distances of only a few millimetres (mm) — extremely short when compared with the average 10 cm distances that "normal" fragments survived prior to collision.

Surprised by this, she proceeded with a systematic investigation of the effect and her suspicions were gradually confirmed: it wasn't simply a statistical coincidence; some of the fragments were really behaving in an anomalous way. Definitive proof of the phenomenon, however, required time and a great deal of effort. Only a few percent of the fragments behaved in this way and they had to be identified and carefully measured among the much more numerous "normal" fragments. Finally, in 1967, the measurements produced convincing evidence that a few per cent of the lighter fragments (ranging from hydrogen to beryllium) exhibited some property which enhanced their chances of collision by a factor of five to ten times that of normal nuclei. They behaved as if their sizes or the range of forces surrounding them had expanded considerably. No explanation based on conventional nuclear physics could be found for this effect. Clearly, some process has occurred during the collision which has altered the nature of the fragments in a drastic way.

"Previous to this work," comments Dr. Judek, "it had been assumed that the secondary fragments from cosmic rays would behave in the same way as primary nuclei of similar sizes. They are parts of the original projectile nucleus, but they are made up of the same particles as the smaller primaries, protons and neutrons, and held together by the same nuclear forces."

For Barbara Judek, convincing the rest of the scientific community of the implications of her findings was an entirely different matter. Despite corroborative observations by a group from Minnesota, her work was viewed with considerable skepticism. Looking back, Dr. Judek is philosophic about the initial response from the scientific community: "There were several reasons for this attitude," she says. "The