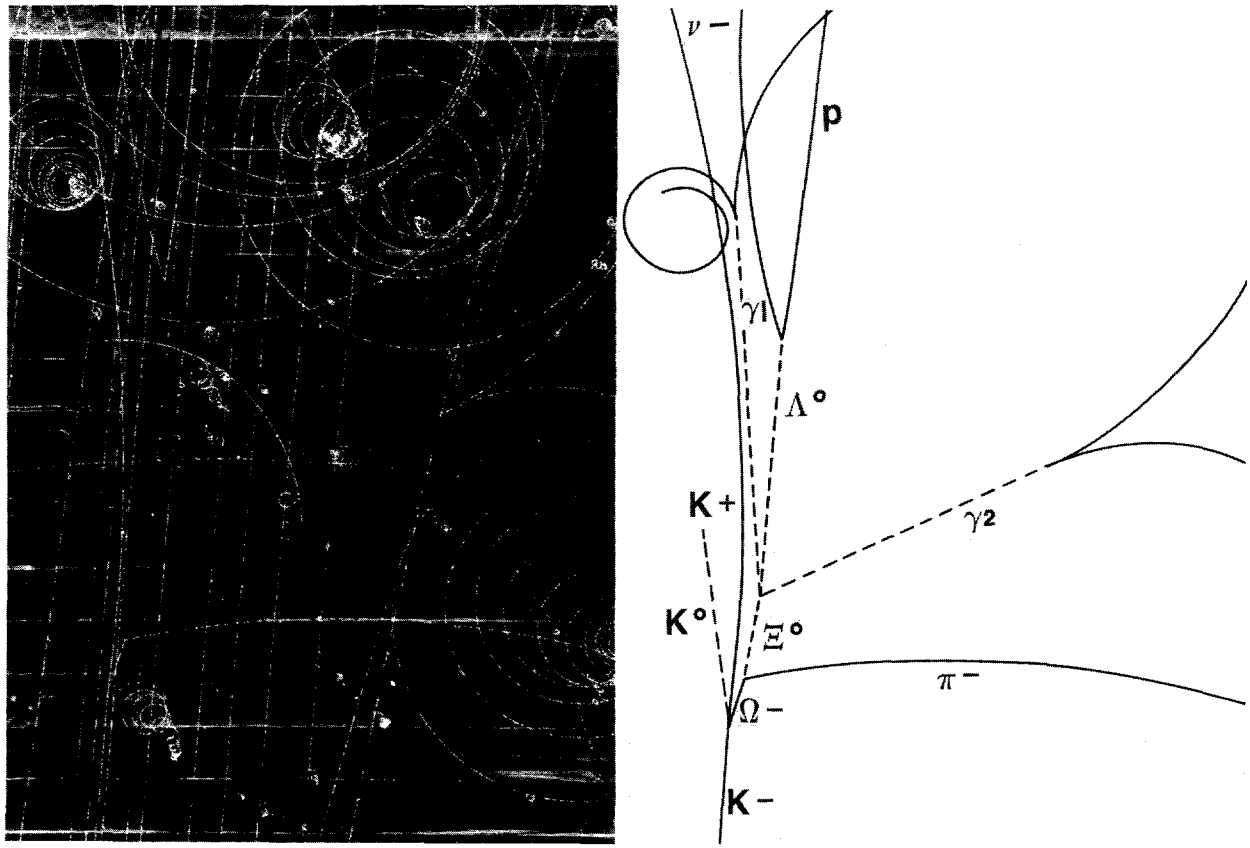

Figure 9. Bubble chamber photo of the first omega-minus event. The omega minus is created at the bottom of the photograph.

eighth spin-0 meson with zero charge and strangeness. Within months it had indeed turned up, with a mass of about 550 MeV, in bubble chamber searches at Berkeley and Brookhaven. Dubbed the *eta meson* (η°), this new particle completed the octet of spin-0 mesons. Soon another octet, that of spin-1 mesons like the K*, had also been fleshed out.

To Gell-Mann and other physicists of the early 1960's, these regular patterns were concrete evidence of a harmonious grouping of the hadrons called *unitary symmetry* or, more specifically, *SU(3) symmetry*. Although their masses and other properties might appear different, the members of a given octet are closely related to one another by symmetry transformations similar to the rotations of a cube. If you rotate a cube through 90° or 180° about an axis drawn through the centers of two opposite faces, for example, it ends up looking the way it did before you began. The colors of the faces might change as upon rotation, but the final shape is the same.

Unitary symmetry does not require that *every* hadron belong to an octet. There can be groupings of 1, 3, 10, 27, and even more. In fact, it was the verification of the ten-member group, or *decimet,* that convinced most physicists of the validity of this idea. The spin-3/2 baryon resonances were predicted to fall into such a decimet, and by 1962 nine of these particles had indeed been discovered.

Based on the evidence presented at an international conference held that summer, Gell-Mann predicted the existence of the tenth spin-3/2 resonance with a mass of 1,685 MeV and strangeness

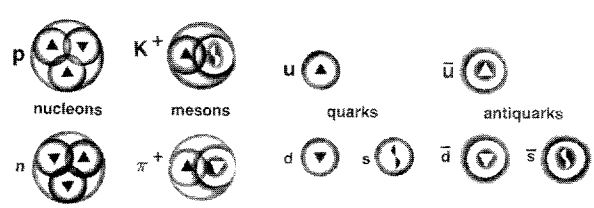

Figure 10. Nucleons are composed of quarks; mesons of quarks and antiquarks.