On the Transverse-Momentum Distribution of Secondary Particles from High-Energy Collisions.

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In a recent paper FRIEDLÄNDER (1) states that *only* a Boltzmann-type distribution in transverse momentum of particles emitted in a high-energy collision is compatible with axial symmetry about the collision axis. He refers to a paper by ALY, KAPLON and SHEN (2) for the proof of this statement. It is the purpose of this note to point out that the « proof » of Aly, Kaplon and Shen is in error and that in fact the Boltzmann-type distribution does not follow from axial symmetry alone.

What this argument essentially says is that a function of the type

$$(1)\quad N(p_t)\,\mathrm{d}p_t = 2\alpha p_t \exp[-\alpha p_t^2]\,\mathrm{d}p_t\,,$$

is the *only* function that has axial symmetry. This is, on the face of it, untrue because *any* distribution that is a function of p_t alone and not a function of the azimuth angle φ has axial symmetry. The fault lies in eq. (1) of Aly, Kaplon and Shen which the authors state to be an expression of axial symmetry. This equation,

$$(2)\quad N(p_t) = f(p_x)\cdot f(p_y) = F(p_t^2)\,,$$

where

$$p_t^2 = p_x^2 + p_y^2\,,$$

is, in fact, *not* just a statement of axial symmetry (this is contained in the statement that it is a function of p_t alone) but is in addition a statement of statistical independence of the distribution in p_x and p_y. This is quite a bit more than simple symmetry. It is well known that when one demands symmetry *and* independent distribution in the rectangular co-ordinates one is led automatically to a Boltzmann-type distribution. In fact it is just this combination of assumptions that led Maxwell to his famous velocity distribution law, and it is the assumption of independence that is considered to be the weakest part of his derivation (3).

(1) E. M. FRIEDLÄNDER: *Nuovo Cimento*, **41**, 417 (1966).

(2) H. H. ALY, M. F. KAPLON and M. L. SHEN: *Nuovo Cimento*, **31**, 905 (1964).

(3) J. JEANS: *An Introduction to the Kinetic Teorhy of Gases*, Cambridge University Press, Cambridge (1948), Appendix I, p. 296.