On the Covering Law
in Quantal Proposition Systems

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Abstract. A recent justification of the covering law by Jauch and Piron founded on the existence of ideal measurements of the first kind is shown to contain a gap. This gap is closed by an additional assumption about such measurements.

§ 1

In a recent paper [1], Jauch and Piron tried to found the atomicity and the validity of the covering law in the proposition systems of quantum-mechanical objects onto a new concept of state and on the existence of ideal measurements of the first kind. But their derivation of the covering law contains a gap. In the present paper we show at first by means of a counter-example that the assumptions of Jauch and Piron are not sufficient to derive the covering law. Thereupon we introduce an additional plausible assumption about ideal measurements of the first kind which enables – in conjunction with the assumptions of [1] – the establishment of the covering law.

Remark. As in the present paper we simply presuppose the atomicity of quantal proposition systems which Jauch and Piron justified on the basis of a new concept of state, we can evade the problematic hypotheses connected with this new state concept; consequently, our considerations are independent of these hypotheses, and they concern only the dependence of the covering law upon other more plausible properties of quantal proposition systems.

§ 2

We start by compiling the assumptions from which Jauch and Piron tried to derive the covering law. As the physical substantiation of these assumptions is not the subject of the present paper, we immediately combine a great many assumptions which are not at all trivial, to the following axiom:

Axiom I. In the set L of the propositions of a quantum-mechanical system there exist a partial order relation $\leq$ and an orthocomplementa-