ABSTRACT. We forward an epistemological perspective regarding non-classical logics which restores the universality of logic in accordance with the thesis of "global pluralism". In this perspective every non-classical "truth-theory" is actually a theory of some metalinguistic concept which does not coincide with the concept of truth (described by Tarski's truth theory). We intend to apply this point of view to Quantum Logic (QL) in order to prove that its structure properties derive from properties of the metalinguistic concept of testability in Quantum Physics. To this end we construct a classical language $L_c$ and endow it with a classical effective interpretation which is partially inspired by the Ludwig approach to the foundations of Quantum Mechanics. Then we select two subsets of formulas in $L_c$ which can be considered testable because of their interpretation and we show that these subsets have the structure properties of Quantum Logics because of Quantum Mechanical axioms, as desired. Finally we comment on some relevant consequences of our approach (in particular, the fact that no non-classical logic is strictly needed in Quantum Physics).

1. INTRODUCTION

Brouwer's proposition of intuitionistic logic as an alternative to Classical Logic (CL) has been followed in this century by the construction of a number of non-classical logics, each of which has been supposed to subtend a non-classical truth theory. Nowadays we are aware of non-classical two-valued logics, three-valued logics, infinite-valued logics, etc., each of which can be endowed with some effective interpretation; correspondingly, we have non-classical two-valued (in particular, intuitionistic) truth theories, many-valued truth theories, fuzzy-truth theories, and so on. Between these non-classical logics, Quantum Logic (QL) plays an important role for physicists and epistemologists, since it is often assumed to be the basic logical apparatus underlying Quantum Physics (see Section 3).

It is well known that this proliferation of truth theories, which strongly favours philosophical relativism regarding the concept of truth, has been considered by many authors (e.g. Putnam, 1969; Dalla Chiara, 1974) as an achievement comparable with the discovery of non-Euclidean geometries in the 19th century; nevertheless it works on a completely different ground (Kneale, 1962) (in particular, we think that the
distinction between logical and specific theories is epistemologically important) and it is exposed to some relevant philosophical and epistemological objections which in our opinion are conclusive.

In the first part of the present paper we intend to forward and discuss (Section 2) a philosophical alternative according to which every non-classical "truth theory" actually is a theory of a metalinguistic concept which is different from the concept of truth (whose properties are exhaustively described by the Tarski truth theory, hence by CL). This alternative, if accepted, has the advantage of recovering the universality of logic according to the thesis of the global pluralism (Haack, 1978), since it entails that different structures can coexist in the same fragment of a natural language, so that no contradiction exists between classical and non-classical structures.

In order to support our perspectives we can quote at least two cases in which non-classical "truth-theories" can be reinterpreted in terms of some metalinguistic concepts which do not coincide with truth. First, the intuitionistic theory of truth, which can be interpreted as a theory of the pragmatic concept of justification (Dalla Pozza, 1991). Second, the "truth theory" underlying QL, which can be interpreted as a theory of testability in Quantum Physics by making use of the results obtained by us in a recent paper (Garola, 1991).

We will discuss the latter example in the second part of this article, suitably simplifying the complicated formalism introduced in the paper quoted above. With this in mind, we preliminarily affirm the centrality of the concept of testability in every physical theory (Section 3), and suggest some refinements in the conventional approach to the aims of physical theories, or received viewpoint, based on the distinction between truth and testability. Then, we illustrate our general epistemological perspective by proving that the formulas of QL can be interpreted as subsets of testable formulas of a classical language with Tarskian semantics and that the structure properties of QL derive from properties of the concept of testability in Quantum Physics. This result is obtained as follows: after some general remarks in Section 4, we construct a classical language $L_c$ in Section 5 and endow it with a classical effective interpretation which has been partially inspired by Ludwig's approach to the foundations of Quantum Mechanics (1983); then, we select in Section 6 two subsets of formulas of $L_c$ which can be considered testable because of their interpretations, and show that these are endowed with