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FROM ČERENKOV RADIATION TO GENERALIZED SUPER-ČERENKOV EXOTIC DECAYS

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Abstract. *Generalized Super-Čerenkov Radiations (SČR), as well as their SČR-signatures are investigated. Two general SČR-coherence conditions are found as two natural extremes of the same spontaneous particles decays in (dielectric, nuclear or hadronic) media. The main results on the experimental test of the super-coherence conditions, obtained by using the experimental data from BNL, are presented. The interpretation of the observed anomalous Čerenkov rings as experimental evidence for the HE-component of the SČR is discussed.*

Key words: Čerenkov radiation, Super-Čerenkov effect, Anomalous Čerenkov rings, Nuclear pionic Čerenkov-like radiation (NPIČR), particle refractive index

1. Introduction

The classical theory of the radiation emitted by charged particles moving with superluminal velocities were traced back to Heaviside [1]. In fact, Heaviside considered the Čerenkov radiation [2] in a nondispersive medium. He considered this topic many times over the next 20 years, deriving most of the formalism of what is now called Čerenkov radiation and which is applied in the particle detectors technics (e.g., RICH-detectors). So, doing justice (see the papers of Kaiser and Jelley in Nature) to Heaviside [1] De Coudres [3] and Sommerfeld [4], we must recall that the classical theory of the CR phenomenon in a dispersive medium was first formulated by Frank and Tamm in 1937 [5]. This theory explained all the main features of the radiation observed experimentally by Čerenkov [2] (see Fig. 1).

In fact, from experimental point of view, the electromagnetic Čerenkov radiation was first observed in the early 1900's by the experiments developed by Marie and Pierre Curie when studying radioactivity emission. In essence they observed that phenomenon consists from the very faint emission of a bluish-white light from transparent substances in the neighborhood of strong radioactive source. But the first deliberate attempt to understand the origin of this light was made by Mallet [6] in 1926-1929. He observed that this light emitted by a variety of transparent bodies placed close to a radioactive source always had the same bluish-white quality, and that the spectrum was continuous, not possessing the line or band

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