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The eikonal model of reactions involving exotic nuclei; Roy Glauber's legacy in today's nuclear physics

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In the late 1950s, Roy Glauber introduced the eikonal approximation within quantum-collision theory [1]. Since then, it has been applied to a wide variety of cases, ranging from atomic physics to particle physics. In nuclear physics, the interest in this model of reactions has been revived by the development of Radioactive-Ion Beam (RIB) facilities, where nuclear structure can be probed far from stability. In such facilities, the structure of radioactive nuclei is mostly studied through reactions. An accurate model of reactions is thus needed to reliably infer nuclear-structure information from reaction measurements. The eikonal model introduced by Roy Glauber has been widely used to study the single-particle structure of exotic nuclei through knockout reactions at high energy [2]. It also provides a very reliable model of reactions involving halo nuclei at intermediate and high energy [3,4].
In this contribution, after a brief presentation of the eikonal approximation, I will review its use in modern nuclear physics and the exciting results this model of reactions has enabled today's nuclear physicists to obtain far from stability. In addition, I will discuss the various improvements that have been introduced to extend its range of validity, e.g., to include the dynamics of the projectile within the model of the reaction [3,4,5], to use it al low beam energy [6,7,8], or to include relativistic effects at high energy [9,10].
This series of examples illustrates the impact the eikonal approximation introduced by Roy Glauber sixty years ago has had, and certainly will continue to have, in the exciting and developing field of nuclear-reaction theory.

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