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The Correspondence Between Leaky-Box and Diffusion Models of Cosmic-Ray Propagation

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The leaky-box model and the attendant concept of path-length distribution were invented in the mid-1960's. Even though versatile computational packages such as GALPROP and DRAGON with the diffusion approach are now available for analysis, the concepts leaky-box and the path-length distribution continue to be adopted extensively (often with an apology for their inexactitude). We show here mathematically that there is a close correspondence between the two approaches: The path-length or resident-time distributions of the leaky-box models are similar to 'impulse response functions' of complex dynamical systems and are intuitively transparent. The results provided by the leaky-box model are valid when used judiciously.

Collaboration(s)

Author: COWSIK, Ramanath (Washington University in St. Louis)

Co-author: Dr HUTH, Dawson

Presenter: COWSIK, Ramanath (Washington University in St. Louis)

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