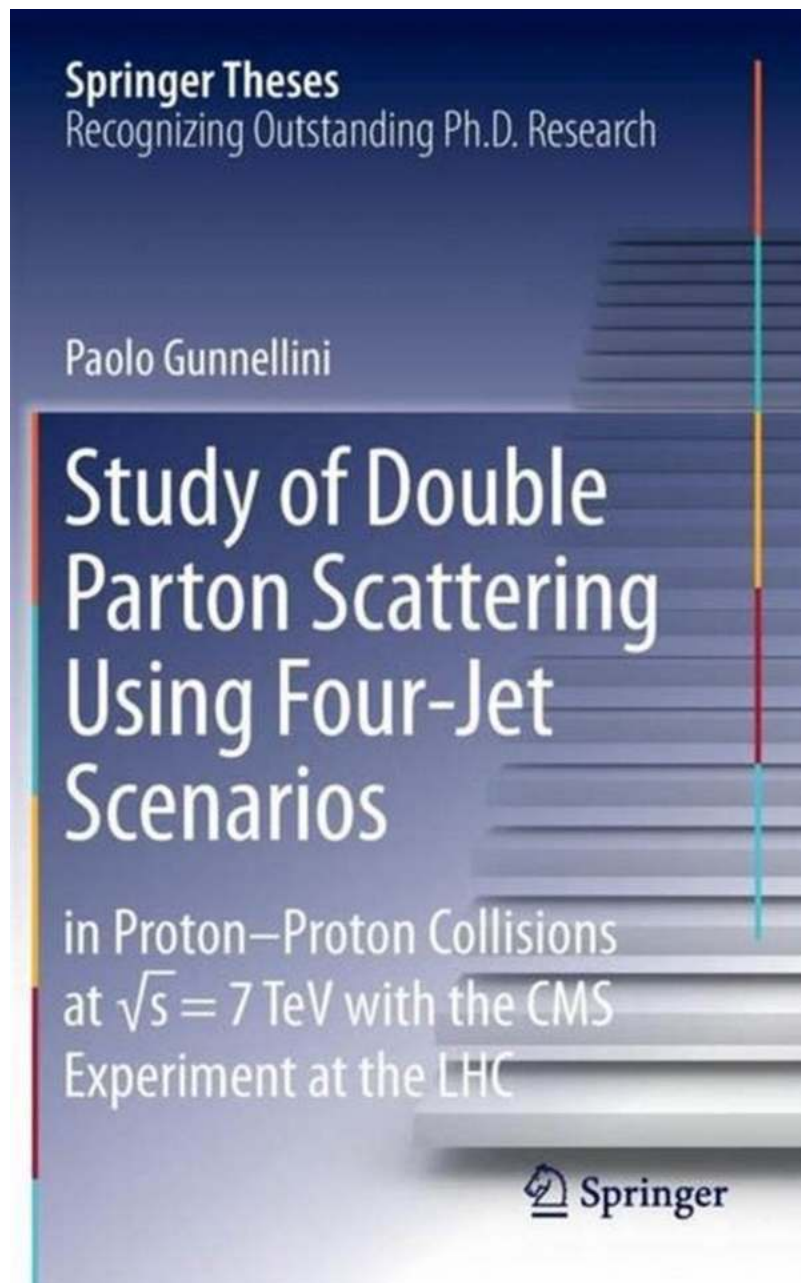


# Discover the Secrets of Double Parton Scattering Using Four Jet Scenarios

Unveiling the Astonishing Phenomenon in Particle Physics

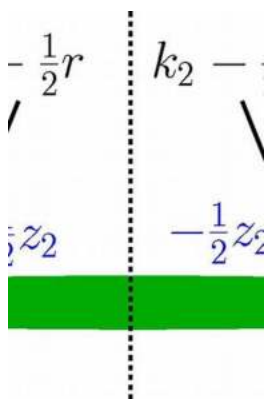


Particle physics is a vast and captivating field that seeks to understand the fundamental building blocks of our universe and the forces that govern their

interactions. One intriguing phenomenon that has puzzled scientists for decades is double parton scattering (DPS), a rare occurrence that involves two simultaneous interactions between different pairs of partons. In this article, we delve into the study of double parton scattering using four jet scenarios and unlock the secrets behind this fascinating phenomenon.

## Understanding Partons and Jets

Before we dive into the realm of double parton scattering, let's take a moment to comprehend the two crucial aspects involved: partons and jets. Partons are the constituents of hadrons, which include protons and neutrons. They can be viewed as the individual particles inside these larger particles. Jets, on the other hand, are collimated streams of particles resulting from high-energy interactions, typically observed in powerful particle colliders like the Large Hadron Collider (LHC) or the Tevatron.



### Study of Double Parton Scattering Using Four-Jet Scenarios: in Proton-Proton Collisions at $\sqrt{s} = 7$ TeV with the CMS Experiment at the LHC (Springer Theses)

by Chris Colston (1st ed. 2016 Edition, Kindle Edition)

★★★★☆ 4.8 out of 5

Language : English

File size : 16316 KB

Text-to-Speech : Enabled

Screen Reader : Supported

Enhanced typesetting : Enabled

Print length : 299 pages



In the context of particle physics experiments, jets serve as experimental signatures indicating the presence of high-energy interactions. By studying the properties of these jets, scientists can gain valuable insights into the underlying processes and interactions within the particle collisions. Jets can be categorized based on the number of partons involved, with four jet scenarios being particularly relevant in exploring double parton scattering.

## **The Enigmatic Nature of Double Parton Scattering**

Double parton scattering is a rare phenomenon where two pairs of partons interact simultaneously, leading to four jets in the final state. It is a complex process that occurs only in a small fraction of particle collisions. Understanding and accurately modeling DPS is crucial for predicting and interpreting experimental results, as it can significantly impact measurements of various particle properties.

Scientists have observed double parton scattering in several high-energy experiments, including those at the LHC. However, fully understanding this phenomenon requires a detailed study of its properties and characteristics, which can be achieved through the exploration of four jet scenarios.

## **Studying DPS Using Four Jet Scenarios**

The study of double parton scattering using four jet scenarios involves analyzing the properties of the four jets produced in a collision event. By studying the characteristics of these jets, such as their energies, directions, and angular correlations, scientists can infer crucial details about the underlying scattering processes and deduce whether double parton scattering occurred.

Several experimental approaches and theoretical frameworks have been developed to investigate double parton scattering using various four jet scenarios.

These approaches involve advanced statistical techniques, as well as Monte Carlo simulations, which allow scientists to match the experimental observations with theoretical predictions.

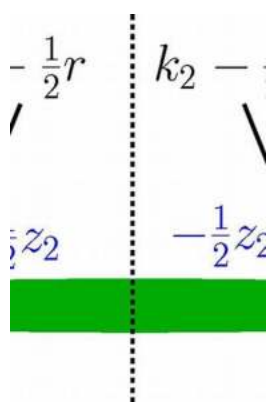
## **Applications and Implications**

Understanding double parton scattering is not only intellectually stimulating but also crucial for a wide range of applications in particle physics. Accurate modeling of DPS is essential for background estimations in various high-energy experiments. Moreover, it plays a significant role in precision measurements of particle properties, including the determination of parton distribution functions (PDFs) inside hadrons.

Furthermore, studying double parton scattering can shed light on the internal structure of hadrons and probe the parton dynamics at high energies. It provides a unique opportunity to explore the complex quantum chromodynamics (QCD) interactions occurring within particles, ultimately enhancing our understanding of the fundamental laws of nature.

## **In**

The study of double parton scattering using four jet scenarios is an ongoing research area that continues to captivate physicists worldwide. By investigating the properties of the four jets resulting from high-energy collisions, scientists can unravel the mysteries surrounding this rare phenomenon. Understanding double parton scattering not only expands our knowledge of particle physics but also facilitates advancements in experimental techniques and theoretical frameworks. So, join us on this incredible journey as we dive deeper into the fascinating world of double parton scattering and unravel the secrets of the universe.



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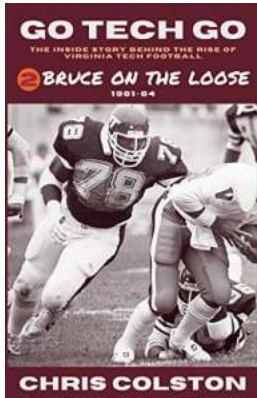
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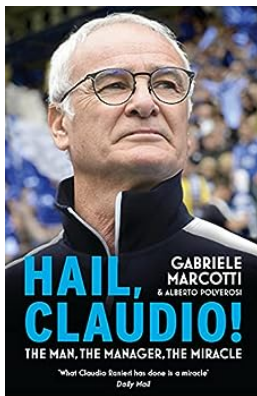
This thesis addresses in a very new and elegant way several measurements and the extraction of so-called double parton scattering. The new and elegant way lies in the combination of measurements and a very smart extraction of double parton scattering results, which is easy to apply and overcomes many of the technical difficulties of older methods. Many new phenomena in particle physics can be observed when particles are collided at the highest energies; one of the highlights in recent years was the discovery of the Higgs boson at the Large Hadron Collider at CERN. Understanding the production mechanism of the Higgs boson at the LHC requires detailed knowledge of the physics of proton-proton collisions. When the density of partons in the protons becomes large, there is a non-negligible probability that more than one parton participates in the interaction and the so-called double parton scattering becomes important. In some cases very particular final state signatures can be observed, which can be regarded as an indication of such double partonic scattering and where the different

interactions can be separated. Such multiple partonic interactions play an important role when precise predictions from known processes are required.



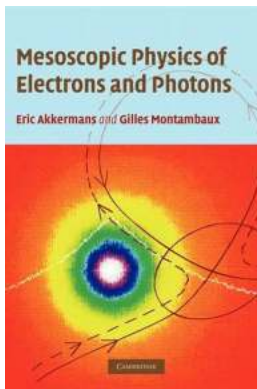
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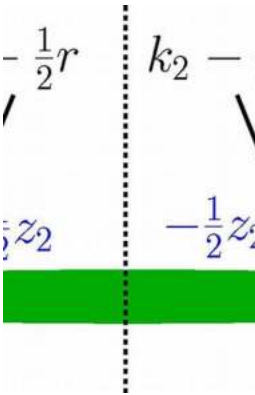
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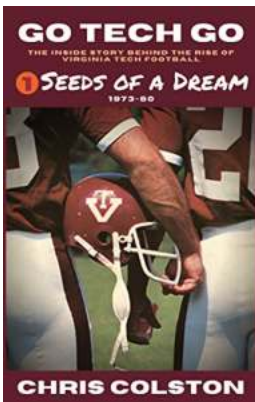
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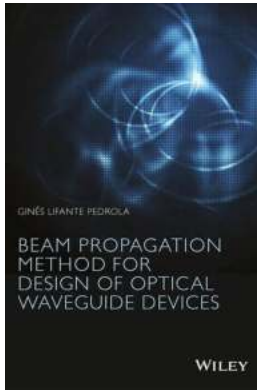
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