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Gaillard M K, Lee B W & Rosner J L. Search for charm.
Rev. Mod. Phys. **47:**277-310, 1975.
[Fermi National
Accelerator Laboratory, Batavia, IL and Univ. Minnesota, Minneapolis, MN1

A systematic study of the expected properties of charmed particles was presented with the aim of guiding experimental searches for these states, which had been predicted, but for which scant experimental evidence existed at the time. [The *SCI®* indicates that this paper has been cited over 540 times since 1975.]

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"I arrived for a year's visit at the Fermi Laboratory in the fall of 1973, a period when important new theoretical developments offered for the first time the possibility of constructing a viable theory of the weak interactions. However there was considerable disarray among theorists as to what specific form the theory would take, partly because there was disagreement among experimental groups over data on neutrino-induced phenomena which were predicted in a wide class of these theories, and also because every theory required the existence of so-far unobserved particles. The most attractive scheme was based on a proposal[1] made three years earlier by Glashow, Iliopoulos, and Maiani, who had argued for the existence of a quark carrying a new quantum number called 'charm.'

"The leader of the Fermi Laboratory theory group at the time was Benjamin Lee, who had played a significant role in the earlier theoretical developments. While discussing possible approaches, we noted a phenomenon in the weak decays of kaons which appeared at first sight to present a problem for the charm scheme. Upon a more careful analysis,[2] we realized that all the systematics of kaon decays could be understood within the charm framework if the charmed quark was about twice as heavy as the proton. This meant that charmed particles were being produced in on-going experiments and that their detection should be possible. About that time I was asked to participate in a panel discussion on neutrino physics, so I made a quick survey of signatures for charm production, after which one experimenter commented: 'Some of our data look like that' Encouraged, Ben and I began detailed studies of more general charm production signatures. We joined forces with John Rosner of the University of Minnesota, who had independently been studying and encouraging charm searches for some time.

"One of the particles predicted was a so-called 'hidden charm' state. While our work was still being circulated as a preprint in November 1974, the ø/J particle, closely resembling hidden charm, was dramatically uncovered in simultaneous experiments at the Stanford Linear Accelerator Center and at Brookhaven National Laboratory, resulting in the 1976 Nobel Prize for Burton Richter and Samuel Ting. However, the charm interpretation was only one of many possibilities, and it was unambiguously confirmed only in the spring of 1976, after intense experimental searches for other charmed particles bore fruit. The impact of our paper was largely due to timing: the ø/J strongly suggested that charm was there to be found, and we had provided a handbook for the search, although many of our guidelines were of necessity based on educated intuition and were subsequently improved with the help of new developments in the understanding of quark bound states.

"In 1977 I was awarded the Prix Thibaud by the Academie des Sciences, Belles-Lettres et Arts de Lyon, an occasion unfortunately saddened by the tragic death of my close friend and collaborator, Benjamin Lee."

1. **Glashow S L, Iliopoulos J & Maiani L.** Weak interactions with lepton-hadron symmetry.
Phys. Rev. D 2:1285-92, 1970.
[Citation Classic. *Current Contents/Physical, Chemical & Earth Sciences* (20): 10, 19 May 1980.]
2. **Gaillard M K & Lee B** W. Rare decay modes of the K mesons in gauge theories.
Phys. Rev. D 10:897-916, 1974.