

Freeman Dyson's Challenge For The Future: The Mock Theta Functions

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Wednesday, November 19, 2008

008 Kemeny Hall, 4:00 pm
(Tea 3:30 pm 300 Kemeny Hall)

Abstract

In his last letter to Hardy (written on his death bed), Ramanujan gave examples of 17 functions he referred to as “mock theta functions”. Without a definition and without good clues, number theorists were unable to make any real sense out of these peculiar functions. Nevertheless, these examples make important appearances in many disparate areas of mathematics, a fact which inspired Freeman Dyson to proclaim:

“Mock theta-functions give us tantalizing hints of a grand synthesis still to be discovered. Somehow it should be possible to build them into a coherent group-theoretical structure... This remains a challenge for the future. My dream is that I will live to see the day when our young physicists, struggling to bring the predictions of superstring theory into correspondence with the facts of nature, will be led to enlarge their analytic machinery to include not only theta-functions but mock theta-functions.” –Freeman Dyson, 1987

In this lecture I will describe the solution to this challenge and give an indication of some of the open problems which have now been solved as a result.