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A substantial part of the richness of the theory of matroids and oriented matroids lies in the fact that they each can be axiomatized in a number of equivalent - or cryptomorphic - ways. In the last two decades some work has been devoted to the search for a combinatorial abstraction of linear dependency over the complex numbers as a parallel to the corresponding theories for general and real linear dependency, given respectively by matroid theory and oriented matroid theory. We will present our attempt at a theory of complex matroids that shares much of the structural richness of oriented matroid theory. In particular, our theory has several cryptomorphic axiomatizations and a satisfactory notion of duality. Moreover, some of the subtleties arising in the development of this theory shed a new light on known aspects of matroid theory. (Received July 25, 2011)