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In this talk, I will discuss recent joint work with Laurent Bienvenu and Antoine Taveneaux on the limitations of probabilistic computation in the context of algorithmic randomness. More specifically, I will highlight our work on deep  $\Pi_1^0$  classes, where a  $\Pi_1^0$  class  $\mathcal{P}$  (i.e., an effectively closed subclass of  $2^\omega$ ) is *deep* if it is maximally difficult to produce an initial segment of a member of  $\mathcal{P}$  via any probabilistic algorithm (understood as a Turing machine equipped with an algorithmically random oracle). I will lay out some basic properties of deep  $\Pi_1^0$  classes and will provide a number of examples from computability theory. (Received September 16, 2013)