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Phase retrieval just celebrated its 100th anniversary. It has broad application to x-ray crystallography, electron microscopy, astronomical imaging, optics, and much more. We will see that some fundamental results in phase retrieval extend to the infinite dimensional case while other fundamental results fail. In particular, we will see that phase retrieval in infinite dimensional Hilbert spaces is never uniformly stable. We will also give sufficient conditions for phase retrieval in infinite dimensions and give a number of examples. (Received January 16, 2016)