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Early science results from the Van Allen probes - invited talk

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The discoveries and understandings achieved by the Van Allen Probes science investigations are fundamental and extensive. We first focus on a few of the discoveries where a mystery or controversy has essentially been resolved through a combination of new, high quality data and effective modeling of the processes. We highlight one unanticipated behavior of the radiation belts, the third radiation belt, and show how modeling uncovered the explanation for how and why that occured. We also show how the long-standing issue of local electron acceleration can be explained using high resolution measurements and modeling of local chorus waves. But there are many unresolved problems in the inner magnetosphere; we point to a few of these unresolved problems and show progress to date. For example, we can shed light on the process of electron loss from the radiation belt using Van Allen data in conjunction with BARREL balloon measurements. This highlights the progress that can be achieved through joint measurements of similar phenomena in different regions of the magnetosphere. Although the Van Allen Probes are greatly enhancing our understanding of radiation belt processes, much remains to be done and there is a continuing need for high quality measurements that can complement the existing satellites.