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**Christian Borgs** and **Jennifer T Chayes\*** (jchayes@microsoft.com), Microsoft Research, One Memorial Drive, Cambridge, MA 02142, and **Henry Cohn** and **Yufei Zhao**. *An  $L^p$  theory of sparse graph limits I: limits, sparse random graph models, and power law distributions.*

We introduce and develop a theory of limits for sequences of sparse graphs based on  $L^p$  graphons, which generalizes both the existing  $L^\infty$  theory of dense graph limits and its extension by Bollobás and Riordan to sparse graphs without dense spots. In doing so, we replace the no dense spots hypothesis with weaker assumptions, which allow us to analyze graphs with power law degree distributions. This gives the first broadly applicable limit theory for sparse graphs with unbounded average degrees. (Received September 15, 2014)