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**Jean Bourgain** and **Stephen J Dilworth\*** (dilworth@math.sc.edu), Department of Mathematics, University of South Carolina, Columbia, SC 29208, and **Kevin Ford**, **Sergei Konyagin** and **Denka Kutzarova**. *Explicit Constructions of RIP Matrices and Related Problems.*

We give a new explicit construction of  $n \times N$  matrices satisfying the Restricted Isometry Property (RIP). Namely, for some  $\varepsilon > 0$ , large  $N$  and any  $n$  satisfying  $N^{1-\varepsilon} \leq n \leq N$ , we construct RIP matrices of order  $k^{1/2+\varepsilon}$  and constant  $\delta^{-\varepsilon}$ . This overcomes the natural barrier  $k = O(n^{1/2})$  for proofs based on small coherence, which are used in all previous explicit constructions of RIP matrices. Key ingredients in our proof are new estimates for sumsets in product sets and for exponential sums with the products of sets possessing special additive structure. We also give a construction of sets of  $n$  complex numbers whose  $k$ -th moments are uniformly small for  $1 \leq k \leq N$  (Turán's power sum problem), which improves upon known explicit constructions when  $(\log N)^{1+o(1)} \leq n \leq (\log N)^{4+o(1)}$ . This latter construction produces elementary explicit examples of  $n \times N$  matrices that satisfy RIP and whose columns constitute a new spherical code; for those problems the parameters closely match those of existing constructions in the range  $(\log N)^{1+o(1)} \leq n \leq (\log N)^{5/2+o(1)}$ . (Received September 07, 2010)