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**Novel structures from the densest binary sphere packings** ADAM HOPKINS, YANG JIAO, FRANK STILLINGER, SALVATORE TORQUATO, Princeton University — The densest binary sphere packings have historically been very difficult to determine. The only rigorously known packings in the $\alpha$-$x$ plane of small to large sphere radius ratio $\alpha$ and small sphere relative concentration $x$ are at the Kepler limit $\alpha \to 1$, where packings are monodisperse. Utilizing an implementation of the Torquato-Jiao linear programming algorithm, we find many distinct families of novel densest binary packings and construct a phase diagram for all known densest packings over the $\alpha$-$x$ plane. In particular, these families of densest binary packings are examples of complicated, mechanically stable structures that can appear in colloidal systems without any anisotropic or attractive interactions.

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