We present a new construction of mirror pairs of Calabi-Yau manifolds. On one side of the mirror correspondence are Calabi-Yau manifolds fibered in codimension one by Calabi-Yau submanifolds, for example elliptic fibered K3 surfaces or K3 surface fibered Calabi-Yau threefolds. On the other side are so-called Tyurin degenerations, i.e., smoothings of pairs of quasi-Fano varieties whose common intersection Calabi-Yaus are mirror to the fibers; these correspond to Type II Kulikov degenerations in the K3 surface case and Kawamata-Namikawa smoothings in the case of Calabi-Yau threefolds.

Evidence that the construction produces mirror pairs comes from several directions: The fibered Calabi-Yaus are constructed by gluing the pair of Landau-Ginzburg models mirror to the pair of quasi-Fano varieties, and we establish mirror symmetry of Euler and Hodge numbers. Our construction is compatible with the Batyrev-Borisov mirror construction, wherein a bipartite nef partition produces the structures on both sides and the singular fibers of the fibration encode properties of the Landau-Ginzburg models mirror to the two quasi-Fano varieties. In the case of elliptic fibered K3 surfaces, the KSBA compactification of moduli of pairs suggests a broad correspondence between Type II degenerations of a lattice-polarized K3 surface and elliptic fibrations on its Dolgachev-Nikulin mirror. A complete classification of Calabi-Yau threefolds fibered by mirror quartic K3 surfaces leads to explicit constructions of candidate mirror threefolds and their Tyurin degenerations, showing that our construction is not limited to threefolds constructed as toric complete intersections. Finally, we show that, in the context of homological mirror symmetry, non-commutative K3 fibrations should be mirror to Tyurin degenerations along loci in moduli disjoint from points of maximal unipotent monodromy.