Summary: We explore BPS quivers for $D=5$ theories, compactified on a circle and geometrically engineered over local Calabi-Yau 3-folds, for which many of known machineries leading to (refined) indices fail due to the fine-tuning of the superpotential. For abelian quivers, the counting reduces to a geometric one, but the technically challenging $L^2$ cohomology proved to be essential for sensible BPS spectra. We offer a mathematical theorem to remedy the difficulty, but for non-abelian quivers, the cohomology approach itself fails because the relevant wavefunctions are inherently gauge-theoretical. For the Cartan part of gauge multiplets, which suffers no wall-crossing, we resort to the D0 picture and reconstruct entire KK towers. We also perform numerical checks using a multi-center Coulombic routine, with a simple hypothesis on the quiver invariants, and extend this to electric BPS states in the weak coupling chamber. We close with a comment on known Donaldson-Thomas invariants and on how $L^2$ index might be read off from these.

MSC:

- 83E15 Kaluza-Klein and other higher-dimensional theories
- 81T60 Supersymmetric field theories in quantum mechanics
- 14J32 Calabi-Yau manifolds (algebro-geometric aspects)

Keywords:

- field theories in higher dimensions
- supersymmetric gauge theory
- M-theory
- solitons monopoles and instantons

Software:

SageMath; CoulombHiggs

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References:
