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A support theorem for Hilbert schemes of planar curves

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Consider a family of integral complex locally planar curves whose relative Hilbert scheme of points is smooth. The decomposition theorem of Beilinson, Bernstein, and Deligne asserts that the pushforward of the constant sheaf on the relative Hilbert scheme splits as a direct sum of shifted semisimple perverse sheaves. We will show that no summand is supported in positive codimension. It follows that the perverse filtration on the cohomology of the compactified Jacobian of an integral plane curve encodes the cohomology of all Hilbert schemes of points on the curve. Globally, it follows that a family of such curves with smooth relative compactified Jacobian ("moduli space of D-branes") in an irreducible curve class on a Calabi-Yau threefold will contribute equally to the BPS invariants in the formulation of Pandharipande and Thomas, and in the formulation of Hosono, Saito, and Takahashi.

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