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Homological instability for moduli spaces of 4-manifolds

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We prove that homological stability with respect to connected sums of $S^2 \times S^2$ fails for moduli spaces $B\text{Diff}(X)$ of simply-connected closed 4-manifolds X . This makes a striking contrast with all other even dimensions, where analogous stability has been established by Harer in dimension 2 and by Galatius and Randal-Williams in dimension higher than 4. The proof of the above result is based on a new characteristic class constructed by using 4-dimensional gauge theory. This is joint work with Jianfeng Lin.

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