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Families of 4-manifolds with nontrivial stable cohomotopy Seiberg-Witten invariants, and normalized Ricci flow

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In this article, we produce infinite families of 4-manifolds with positive first betti numbers and meeting certain conditions on their homotopy and smooth types so as to conclude the non-vanishing of the stable cohomotopy Seiberg-Witten invariants of their connected sums. Elementary building blocks used in the earlier work of Ishida and Sasahira are shown to be included in our general construction scheme as well. We then use these families to construct the first examples of families of closed smooth 4-manifolds for which Gromov's simplicial volume is nontrivial, Perelman's lambda-bar invariant is negative, and the relevant Gromov-Hitchin-Thorpe type inequality is satisfied, yet no non-singular solution to the normalized Ricci flow for any initial metric can be obtained. Fang, Zhang and Zhang conjectured that the existence of any non-singular solution to the normalized Ricci flow on smooth 4-manifolds with non-trivial Gromov's simplicial volume and negative Perelman's lambda-bar invariant implies the Gromov-Hitchin-Thorpe type inequality. Our results in particular imply that the converse of this fails to be true for vast families of 4-manifolds.

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