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Breakdown of the scallop theorem with swimmer inertia DAVID GONZALEZ-RODRIGUEZ, MIT, ERIC LAUGA, UCSD — According to the scallop theorem, a swimmer executing a time-reversible (or "reciprocal") motion cannot propel itself in the limit of zero Reynolds number. How much inertia is necessary for a reciprocal motion to become propulsive? Here, we study the breakdown of the scallop theorem for dense swimmers, for which only particle inertia is significant. We apply Lorentz's reciprocal theorem to derive general differential equations that govern the locomotion kinematics of a dense swimmer. We then apply these results to several spatially-asymmetric swimmers and show that they are able to propel themselves at any arbitrarily small value of the particle Reynolds number, even in the absence of fluid inertia.

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