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Ill-posedness for a family of nonlinear and nonlocal evolution equations

We shall discuss the well-posedness of a family of nonlinear and nonlocal evolution equations that includes the Camassa-Holm (CH), the Degasperis-Procesi (DP), and the Novikov equations. In Sobolev spaces H^s with $s < 3/2$, we construct 2-peakon solutions that collide in finite time in a such a way that both the initial profile and the collision time are arbitrarily small. However, at the collision time the H^s norm of the solution is arbitrarily large when $s < 3/2$ but close to $3/2$ thus resulting to norm inflation and ill-posedness. For the remaining Sobolev exponents we prove non-uniqueness. Considering that these equations are well-posed for $s > 3/2$, these results establish $3/2$ as the critical index of their well-posedness. This is work in collaboration with Curtis Holliman and Carlos Kenig.