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Tomonaga-Luttinger liquids: from condensed matter to cold atomic gases

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Interactions effects in quantum systems depend drastically on the dimension. In one dimension these effects are particularly drastic and lead to a special universality class, known as the Tomonaga-Luttinger liquid, with properties quite different from those occurring naturally in higher dimensions.

I will discuss the basics of this state and show how the combination of theoretical developments and recent experiments both in the field of quantum spin systems, and in cold atomic gases have allowed for stringent tests of this physics.

I will then discuss various extensions of this physics to the case of disordered systems, out of equilibrium ones, or when one-dimensional units are coupled. In addition to providing remarkable fundamental challenges these problems are actively investigated experimentally.