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Gravitational Waves from Strong First-Order Phase Transitions

In many extensions of the Standard Model, the electroweak transition is first order - in some cases, strongly so. The ensuing phase transition would result in collisions of bubbles of the new Higgs phase. These collisions, and the associated interactions of sound waves in the plasma, are substantial sources of gravitational waves. For a phase transition at or around the electroweak scale, these gravitational waves may be detectable by future missions such as LISA. They can indirectly provide a probe of particle physics beyond the Standard Model, complementary to future colliders.

However, concrete predictions of the resulting gravitational waves will require good understanding both of the particle physics models themselves, as well as the non-equilibrium physics of the transition. In other words, we need accurate studies of the phase diagrams in the underlying particle physics theories, as well as good predictions of the expected gravitational wave signal from simulations. These feed into one another, forming a so-called 'pipeline'.

The stronger the phase transition, the better the chance of being detected (or constrained) by future missions like LISA. However, strong transitions are also the most poorly understood. In this talk I will discuss some recent results from different points along the 'pipeline', with a focus on the consequences for strong first-order phase transitions.

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