28th Texas Symposium on Relativistic Astrophysics

Contribution ID: **351** Type: **Talk**

3D Quantum Bubble Collisions

Monday, 14 December 2015 15:03 (21 minutes)

First-order phase transitions proceed through the nucleation and subsequent collision of bubbles. In false vacuum eternal inflation, such collision events are ubiquitous and provide a possible avenue to observationally test the multiverse. They also play an important role in early high temperature phase transitions.

I will present results for the full three-dimensional nonlinear dynamics of pairwise bubble collisions, including for the first time the effects of (initially small) quantum fluctuations. This significantly extends the standard treatment of bubble collisions. In the standard approach, the field profile is assumed to possess a spatial SO(2,1) symmetry and the dynamics reduces to one spatial dimension. However, quantum fluctuations break the assumed symmetry and cannot be studied in the symmetry based formalism. I will show that accounting for the dynamics of these fluctuations leads to a complete breakdown of the SO(2,1) symmetry in a wide class of potentials. Initially, the fluctuations experience a linear parametric instability, which can be interpreted as an inhomogeneous version of Bogoliubov particle production. At the onset of mode-mode coupling, the bubble walls in the collision region dissolve, leaving behind a population of localized oscillating blobs of field known as oscillons. This has implications for the production of gravitational waves or black holes during bubble collisions.

Primary author: BRADEN, Jonathan (University College London)

Co-authors: Prof. BOND, J. Richard (CITA); Prof. MERSINI-HOUGHTON, Laura (UNC-Chapel Hill)

Presenter: BRADEN, Jonathan (University College London)

Session Classification: 06 - Early universe