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Magnetic field from sphaleron decay and bubble collisions

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We have performed three dimensional lattice simulations of the magnetic field production during the process of the first-order electroweak phase transition. We show that the magnetic field production can come from sphaleron decay and bubble collisions together, with the former dominates the magnetic field generation process at the first beginning of the bubble nucleation, and the latter dominates the magnetic field production at the stage of the vacuum bubbles accelerating expansion and coalescence. This study can serve as a probe of the bubble wall velocity that is crucial for the baryon asymmetry explanation of the Universe and the gravitational wave production from the first-order phase transition, and also serve as an approach to probe the sphaleron process indirectly. The magnetic field spectrum shows a double peak shape with the increase of the bubble wall thickness.

Summary

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 Theoretical developments & Extra dimensions