



Contribution ID : 106

Type : Oral talk

Gravitational waves from the merger of two primordial black hole clusters

Friday, 2 December 2022 18:50 (15)

The orbital evolution of a binary system consisting of two clusters of primordial black holes is investigated. The formation of such clusters is predicted in some theoretical models. A cluster consists of the most massive central black hole surrounded by smaller black holes. Similarly to single primordial black holes, clusters can form bounded pairs and merge during the orbital evolution. The replacement of single black holes by the clusters significantly changes the entire process and the resulting gravitational wave signal. A new factor is the tidal gravitational interaction of the clusters. It leads to an additional dissipation of the cluster orbital energy, which is transferred into the internal energy of the clusters. As a result, the time of cluster merger can be significantly shorter than the merger time of two black holes under the influence of gravitational radiation alone. Comparison with the gravitational-wave observational data allows one to give a constraints on the amount of primordial black holes in clusters.

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Session Classification : Gravitation and Cosmology

Track Classification : Gravitation and cosmology