Contribution ID: **702** Type: **Poster Presentation**

Hawking radiation from acoustic black hole in relativistic heavy-ion collisions

Monday 4 November 2019 17:40 (20 minutes)

In relativistic heavy-ion collisions, quark-gluon plasma can have a supersonic motion in the longitudinal direction. The quark-gluon plasma also has barotropic equation of state, negligibly small η/s ratio, and irrotational velocity profile (specially in the central collisions, where there is no net initial angular momentum). Thus it can be used to construct an analog model of gravity, and there is possibility to have analog (acoustic) black hole Hawking radiation in the fluid. The plasma in relativistic heavy-ion collisions has a large velocity gradient in the longitudinal direction. Therefore, analog Hawking temperature, produced in the fluid, can not be neglected in comparison to the background temperature of the fluid. Using ultra-relativistic quantum molecular dynamics model (UrQMD), we show that it is possible to have temporarily static sonic horizon in relativistic heavy-ion collisions allowing the applicability of conventional ideas of Hawking radiation. We also study the time evolution of conformal factor (energy density/baryon density where fluid velocity is zero) arising in the acoustic metric and discuss its possible implications (as well as the implications of moving acoustic horizon). We propose possible observational signal for this Hawking radiation in the experiment.

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Session Classification: Poster Session

Track Classification: New theoretical developments