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Parametric instabilities in the earliest stage of heavy ion collisions

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Instabilities play important roles in thermalization of heavy ion collisions since they may affect the emergence of chaoticity and field-particle conversions. In classical Yang-Mills fields, there are several known instabilities induced by color magnetic fields; Weibel and Nielsen-Olesen instabilities. We investigate instabilities of classical gluon fields under the homogeneous, but time dependent color magnetic fields in the linear regime.

Due to the time periodicity of the background magnetic field, we can analyze the stability of fluctuations based on the Floquet theory which consists the basis of the Bloch theory. As a result, we get the complete structure of instability bands appear from parametric resonance and growth rates of fluctuating fields. We find that the parametric instabilities considered here have the different nature from the above two types of instabilities.

In the presentation, we also discuss the relevance of these instabilities to the particle production in the earliest stage of heavy ion collisions.

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