19th MCnet Meeting

Equilibration in QCD with an effective kinetic theory event generator for proton-proton and heavy ion collisions

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ABOUT ME

- Umeå, Sweden.

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- *S-Duality In Supersymmetric Yang-Mills Theory* at Imperial College London.

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- *S-Duality In Supersymmetric Yang-Mills Theory*
  at Imperial College London.
- *Vorticity and Gravitational Wave Perturbations on Cosmological Backgrounds Using the 1+1+2 Covariant Split of Spacetime*
  at Umeå University.

PHD PROJECT

- Complete event generator for proton-proton, proton-ion and ion-ion collisions in SHERPA.

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- Main part: implement an effective kinetic theory describing weakly coupled QCD plasmas in thermal field theory.
- Suitable initial conditions and a hadronisation prescription.

EFFECTIVE KINETIC FIELD THEORY

Boltzmann equations,

$$(\partial_t + \overline{v} \cdot \nabla_{\overline{x}})\, f = -C[f]$$

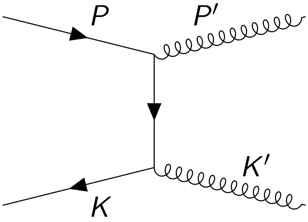
where $f = f(\overline{x}, \overline{p}, t)$ is the phase space density and $C[f]$ is a local collision term, which in this case takes into account a QCD version of LPM effect [1].

[1] P. Arnold, G.D. Moore, and L.G. Yaffe, Journal of High Energy Physics (2003).

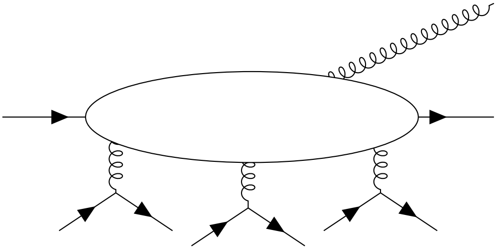
EFFECTIVE KINETIC FIELD THEORY

Processes to include:

$2 \to 2$, e.g.



"$1 \leftrightarrow 2$", e.g.



EFFECTIVE KINETIC FIELD THEORY

Defines collision term,

$$\left(\partial_t + \overline{v} \cdot \nabla_{\overline{x}}\right) f = -C^{2\leftrightarrow 2}[f] - C^{''1\leftrightarrow 2''}[f].$$

POINCARÉ INVARIANCE

- Relativistic mechanics in 8N-dimensional phase space [2] [3] [4].

[2] G. Peter, C. Noack, and D. Behrens, Phys. Rev. C 49 (1994)
[3] D. Behrens, C. Noack, and G. Peter, Phys. Rev. C 49 (1994)
[4] V. Börchers, J. Meyer, St. Gieseke, G. Martens, C.C. Noack, Phys. Rev. C 62 (2000)

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- Relativistic mechanics in 8N-dimensional phase space [2] [3] [4].
- Simplified Hamiltonian, assuming particles to behave as free between binary scatterings, time ordered by frame independent τ, chosen as proper time for massive particles.

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- Given equations of motion from above for $x^\mu(\tau) = x_i^\mu - x_j^\mu$ and $p^\mu(\tau) = p_i^\mu + p_j^\mu$, minimize the Poincaré invariant distance

$$d_{ij}^2(\tau) = -\left(x_\mu - \frac{x_\nu p^\nu}{p^2} p_\mu\right)\left(x^\mu - \frac{x_\nu p^\nu}{p^2} p^\mu\right)$$

to find closest approach.

[2] G. Peter, C. Noack, and D. Behrens, Phys. Rev. C 49 (1994)

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Thank you for listening!