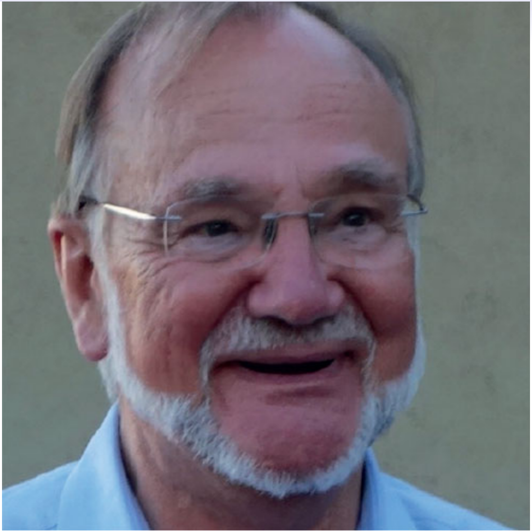
Helmut Oeschler 1945 - 2017

Jean Cleymans
University of Cape Town, South Africa

SQM2017,
Utrecht, The Netherlands, July 9 - 12, 2017



Helmut Oeschler

3.3.1945 - 3.1.2017

Conferences and Workshops in South Africa

11th Chris Engelbrecht Summer School 4 - 13 February 1998
Strangeness in Quark Matter , SQM2004, September 15 - 20, 2004
Launch of the National SA-CERN Programme Monday December 15 2008

Workshop on High Density Nuclear Matter, Stellenbosch, April 6 - 11, 2010

Conferences and Workshops in South Africa

Discovery Physics at the LHC, Kruger Park, December 2010, 2012, 2014

A very productive collaboration

Started in 1997
32 common papers
1 756 citations
published papers have an average of 85.8 citations
one paper is still with the referees...
Never finished: a coherent review of strange particle production in heavy ion collisions.

First Common Paper

PHYSICAL REVIEW C VOLUME 59, NUMBER 3 MARCH 1999

Influence of impact parameter on thermal description of relativistic heavy ion collisions at $(1-2)A$ GeV

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(Received 9 September 1998)

From the introduction to first common paper

It was pointed out by Hagedorn some thirty years ago that thermal models overestimate the production of anti-He^3 in proton-proton collisions by seven orders of magnitude when the grand canonical ensemble is used in its standard form. The reason for this is that when the number of particles as well as the interaction volume are small one has to take into account the fact that the production of anti-He^3 must be accompanied by the production of another three nucleons with energy E_N in order to conserve the baryon number. Thus, the abundance will not be proportional to the standard Boltzmann factor given by

$$n_{\overline{He^3}} \sim \exp\left(-\frac{m_{\overline{He^3}}}{T}\right)$$

but to

$$n_{\overline{He^3}} \sim \exp\left(-\frac{m_{\overline{He^3}}}{T}\right)\left[V\int\frac{d^3p}{(2\pi)^3}\exp\left(-\frac{E_N}{T}\right)\right]^3$$

introduction in 1999

$$n_{\overline{He^3}} \sim \exp\left(-\frac{m_{\overline{He^3}}}{T}\right)\left[V\int\frac{d^3p}{(2\pi)^3}\exp\left(-\frac{E_N}{T}\right)\right]^3$$

since three additional nucleons must be produced in order to conserve the baryon number. This suppresses the rate and introduces a **cubic volume dependence.**

...

From the introduction in 1999

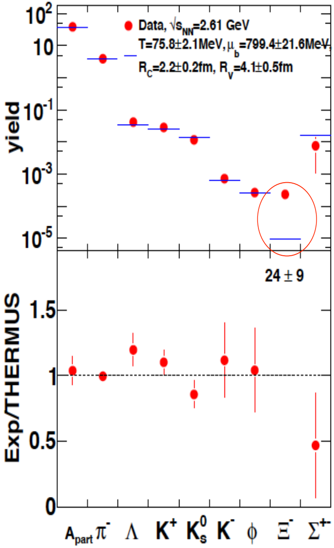
...a similar treatment should be followed for strangeness production in the GSI/SIS energy range. This is not only due to the fact that the size of the system is small but mainly because the temperature is very low and particle numbers are small. The abundance of K^+-mesons is then given by

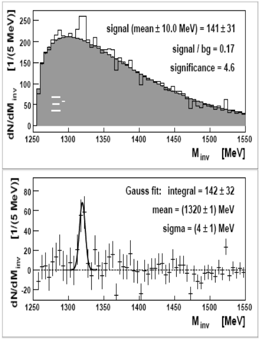
$$n_{K^+} \sim \exp\left(-\frac{m_{K^+}}{T}\right) \left[g_{\overline{K}} V \int \frac{d^3p}{(2\pi)^3} \exp\left(-\frac{E_{\overline{K}}}{T}\right) + g_\Lambda V \int \frac{d^3p}{(2\pi)^3} \exp\left(-\frac{E_\Lambda - \mu_B}{T}\right)\right].$$

since the strangeness must be balanced either by an anti-kaon or by a hyperon. g_i are the degeneracy factors and E_i the particle energies. This leads to a linear dependence of the K^+ density on the size of the system....

This **linear** volume dependence can now be tested for the first time by considering the data on impact parameter dependence which are now becoming available.

Hadrons in Ar+KCl@1.76A GeV





Strong excess of the Ξ^-

NN-threshold:

E_{beam}= 3.74GeV $\rightarrow \sqrt{s}-\sqrt{s_{th}}$=-630MeV!

THERMUS: S. Wheaton, J.Cleymans: Comput.Phys.Commun.180:84-106,2009

Most cited paper

PHYSICAL REVIEW C **73**, 034905 (2006)

Comparison of chemical freeze-out criteria in heavy-ion collisions

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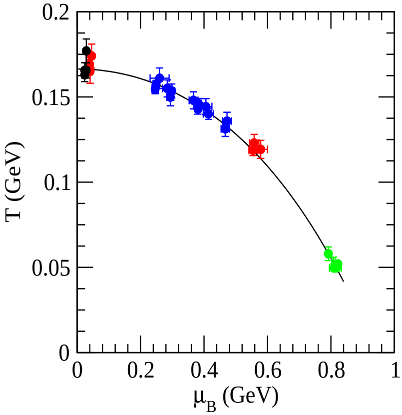
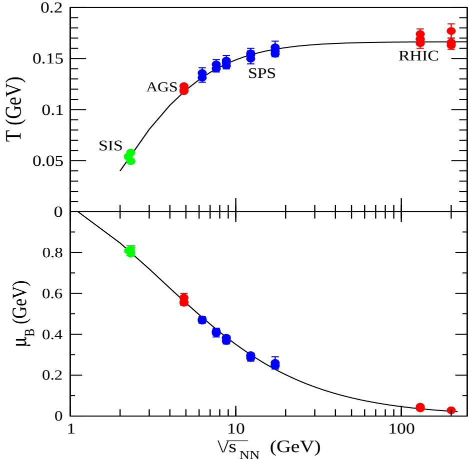
(Received 18 November 2005; published 13 March 2006)

One of the most remarkable results to emerge from heavy-ion collisions over the past two decades is the striking regularity shown by particle yields at all energies. This has led to several very successful proposals describing particle yields over a very wide range of beam energies, reaching from 1 A GeV up to 200 A GeV, using only one or two parameters. A systematic comparison of these proposals is presented here. The conditions of fixed energy per particle, baryon+anti-baryon density, normalized entropy density as well as percolation model are investigated. The results are compared with the most recent chemical freeze-out parameters obtained in the thermal-statistical analysis of particle yields. The sensitivity and dependence of the results on parameters is analyzed and discussed. It is shown that in the energy range above the top AGS energy, within present accuracies, all chemical freeze-out criteria give a fairly good description of the particle yields. However, the low energy heavy-ion data favor the constant energy per particle as a unified condition of chemical particle freeze-out.

2006

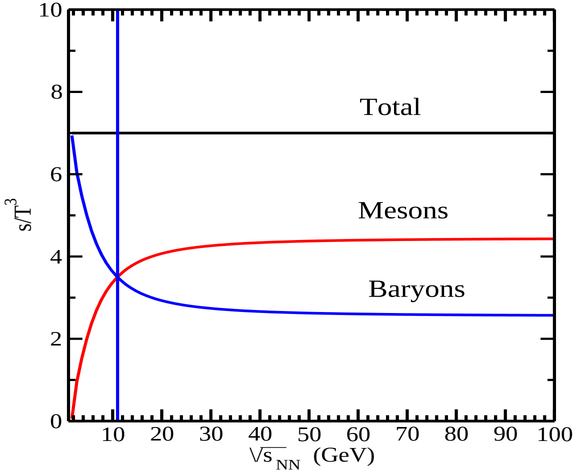


2006



0.2
0.15
0.1
0.05
0
T (GeV)
SIS
AGS
SPS
RHIC
0.8
0.6
0.4
0.2
0
μB (GeV)
1
10
100
√sNN (GeV)

The FAIR/NICA/BES/NA61 energy region.



H. Oeschler et al. Physics Letters B615 (2005) 50-54.

H. Oeschler et al. Phys. Lett. B615 (2005) 50-54

In the statistical model a rapid change is expected as the hadronic gas undergoes a transition from a baryon-dominated to a meson-dominated gas. The transition occurs at a

- temperature $T = 151$ MeV,
- baryon chemical potential $\mu_B = 327$ MeV,
- energy $\sqrt{s_{NN}} = 11$ GeV.

However,
the sharpness of the peak in the K^+/π^+ ratio suggests that something more is happening.
Also, in the thermal model this transition leads to peaks in the $\Lambda/\langle\pi\rangle$, K^+/π^+, Ξ^-/π^+ and Ω^-/π^+ ratios which occur at different beam energies.

H. Oeschler et al. Phys. Lett. B615 (2005) 50-54

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