Joint Institute for Nuclear Research

VERY HIGH MULTIPLICITY PHYSICS

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Status of Very High Multiplicity Physics

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VHM region: structure of phase space

Why the VHM?

Multiplicity distribution

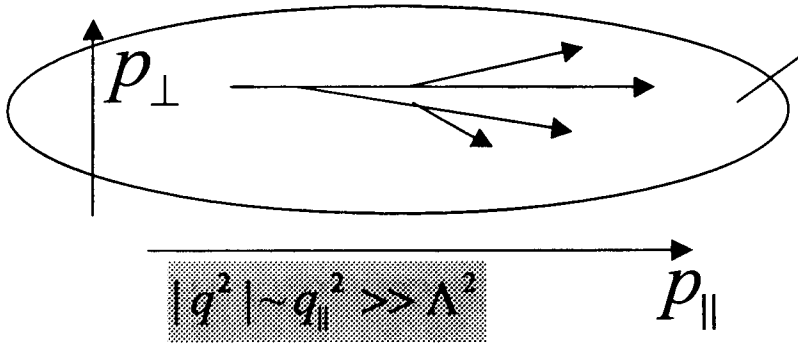
VHM theory

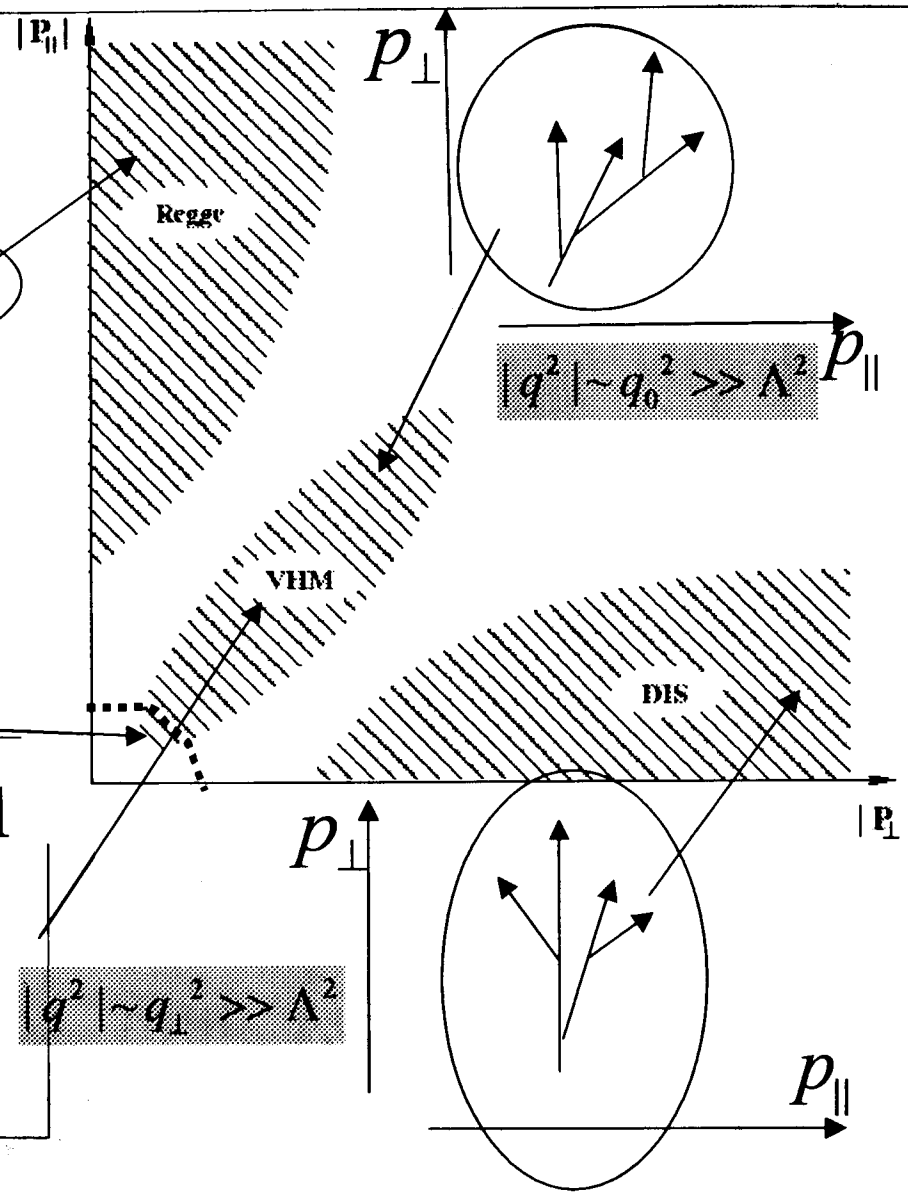
"THERMALIZATION"

Conclusions

VHM region: structure of the phase space

- "Regge" (BFKL, ...)





$|K_3|/|K_2|^{3/2} \sim 1/n$

- "VHM" – low-x: $|K_3|/|K_2|^{3/2} \ll 1$
- L.Gribov et al.; L.Lipatov;
- J.Manjavidze & A.Sissakian;
- L.MacLerran, D.Kharzeev

- "DIS" (DGLAP;...)

Why is VHM?

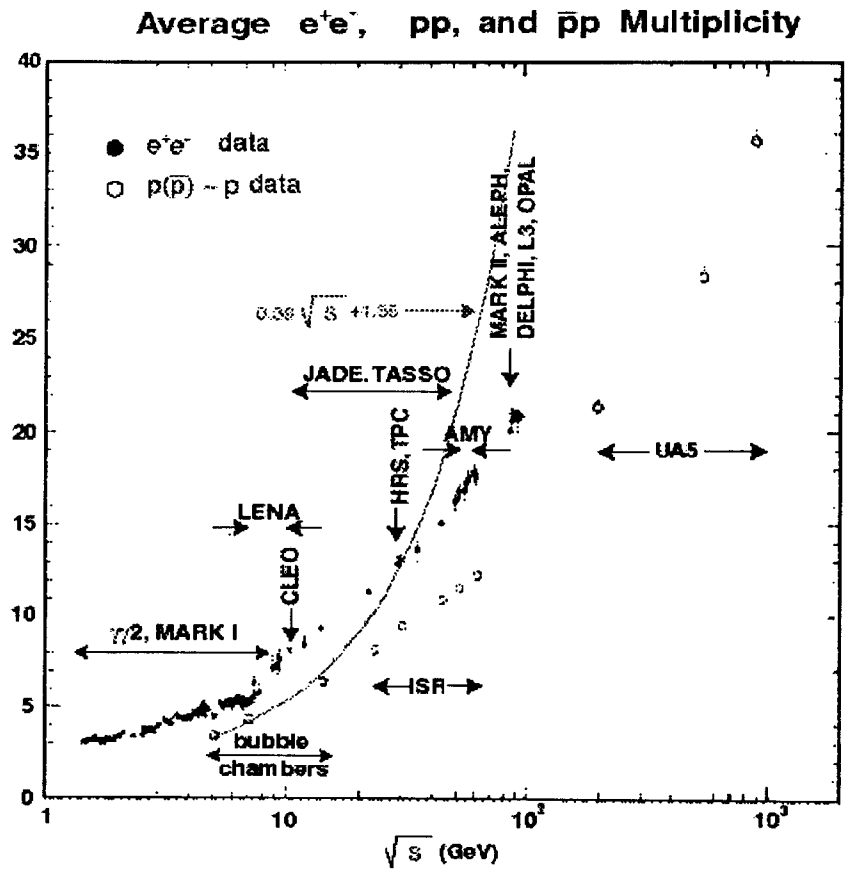
- **The model of Fermi-Landau**

$$\bar{n}_{FL}(s) \sim \sqrt{s} >> \bar{n}_{phys}(s) \sim \ln s$$

threshold multiplicity

- **What will happen if**

$$n \to n_{\max} \sim \sqrt{s}$$

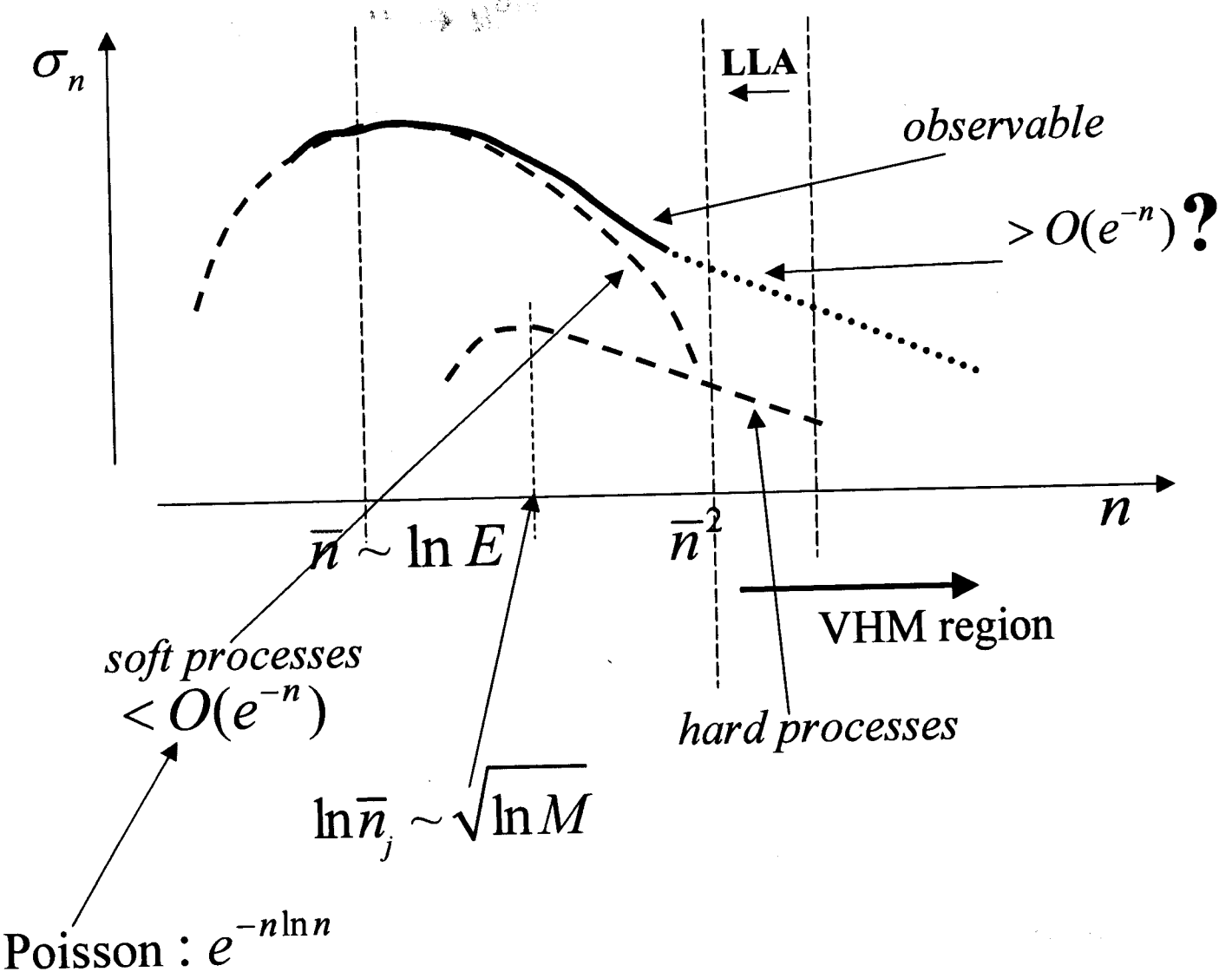


- **Statement: the preventing thermalization constrains must be switched off if**

$$n \to n_{\max}$$

Multiplicity distribution

•*Manjavidze & Sissakian*



VHM theory

•Sissakian, Manjavidze (90,…)

$$\rightarrow \text{no LLA approximation}: |\vec{k}_i| \rightarrow 0,\ |k_\perp| \sim |k_\parallel|$$

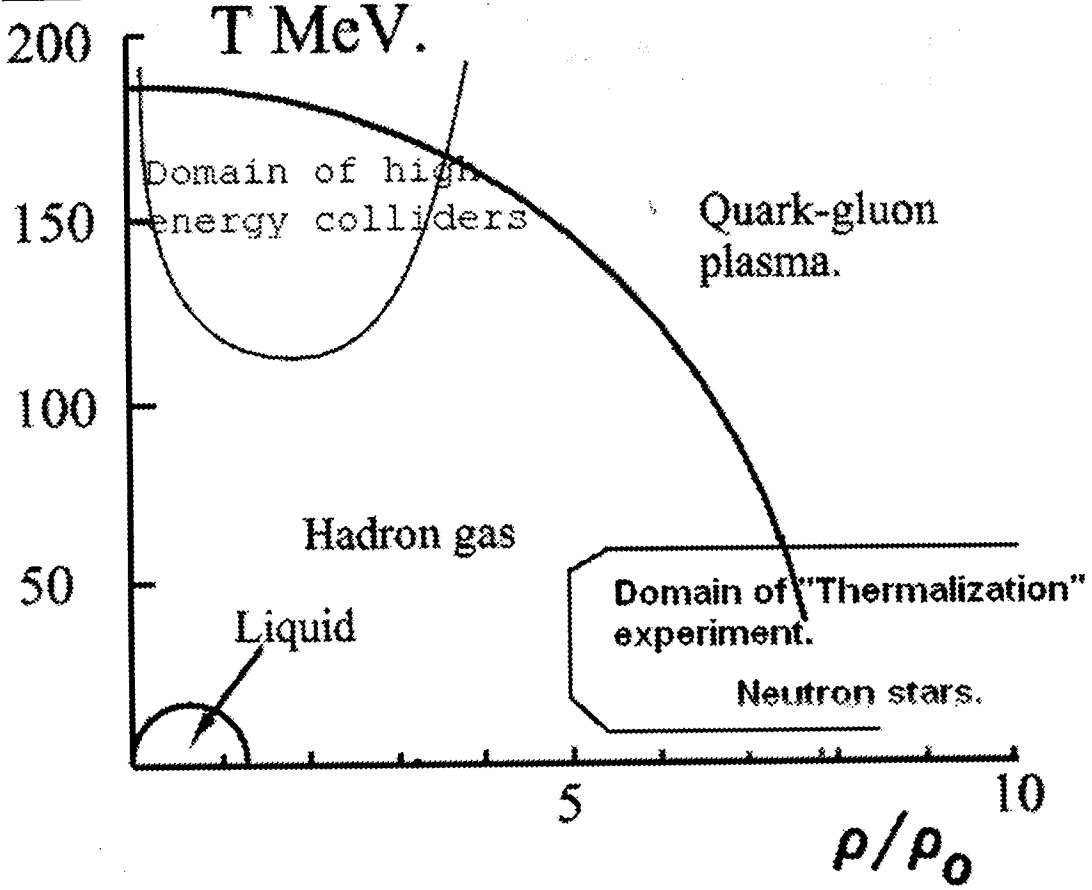
$$\rightarrow \text{no Regge theory}: n > \bar{n}^2(s)$$

$$\rightarrow \left.\begin{array}{l} \text{Regge}: \quad \sigma_n < O(e^{-n}) \\ \text{QCD jet}: \sigma_n = O(e^{-n}) \end{array}\right\} \Leftarrow \text{VHM process is hard } (\alpha_s << 1)$$

$$\rightarrow \text{VHM QCD}: \ q^2 >> \Lambda^2, q_0{}^2 >> (q_\perp{}^2, q_\parallel{}^2)$$

$$\rightarrow \text{thermalization}: \frac{|K_3(n,s)|}{|K_2(n,s)|^{3/2}} << 1$$

"THERMALIZATION"



V.Nikitin et al. (2004)

- Production of **thermalized** state
- **Cold** and **dense equilibrium** state is favorable for QG plasma production
- **Multiparticle** Bose-Einstein correlations

Coll. "Thermalization"

JINR(Dubna), MSU(Moscow), IHEP(Prorvino), TSU(Tbilisi)

P.Ermolov, J.Manjavidze, V.Nikitin, A.Sissakian, et. al.

Conclusions

- **The VHM kinematics region is outside of LLA abilities**

- **Ordinary ("Regge", pQCD in LLA,...) theoretical models can not predict even the tendency to equilibrium**

- **The S-matrix interpretation of thermodynamics permits to show that the thermalization must occur, at least, in a deep asymptotics over multiplicity.**

- **The test of pQCD frames in VHM region is a necessary task**

- **Future: VHM experiment!!!**