VIII SERBIAN-BULGARIAN ASTRONOMICAL CONFERENCE
Lescovac, Serbia, May 8-12, 2012

INHOMOGENEOUS BARYOGENESIS MODEL AND ANTIMATTER IN THE UNIVERSE

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Baryon Asymmetry

Baryon asymmetry of the Universe:

$$\beta = \frac{(n_B - n_{\bar{B}})}{n_\gamma} \sim \frac{n_B}{n_\gamma} = \eta$$

Observational data:

$5.1 \times 10^{-10} < \eta_{BBN} < 6.5 \times 10^{-10}$ at 95% CL

$\eta_D = 6 \pm 0.3 \times 10^{-10}$ at 95% CL

$\eta_{WMAP} = 6.16 \pm 0.16 \times 10^{-10}$ at 68% CL

The explanation of the observed asymmetry is the main goal of the current baryogenesis scenarios.

SC Baryogenesis model

- Attractive features:

  successful BA generation

  compatible with inflation

  successful separation of matter and antimatter domains

  etc.

- Description

  B excess generated at inflationary stage, contained in **< φ >:**

  $$\mathbf{B \sim H_I^{\,3}}$$

  BV at large field amplitude due to BV terms in its potential:

$$U(\varphi) = m^2\varphi^2 + \frac{\lambda_1}{2}|\varphi|^4 + \frac{\lambda_2}{4}(\varphi^4 + \varphi^{*4}) + \frac{\lambda_3}{4}|\varphi|^2(\varphi^2 + \varphi^{*2})$$

  At BC stage B contained in φ is transferred to that of quarks

$$\varphi \to q\bar{q}l\gamma$$

  This asymmetry, eventually further diluted gives the present BAU.

Evolution of B

$$\ddot{\varphi} - a^{-2}\partial_i^2\varphi + 3H\dot{\varphi} + \frac{1}{4}\Gamma\dot{\varphi} + U'_{\varphi} = 0$$

$$\varphi^0_{\max} \sim H\lambda^{-1/4}, \quad \dot{\varphi}_0 = H_I^2$$

After inflation φ oscillates around its equilibrium point with a decreasing amplitude due to Universe expansion and particle production by the oscillating scalar field.

The term $\Gamma\dot{\varphi}$ in the equations of motion explicitly accounts for the damping of φ as a result of particle creation processes.

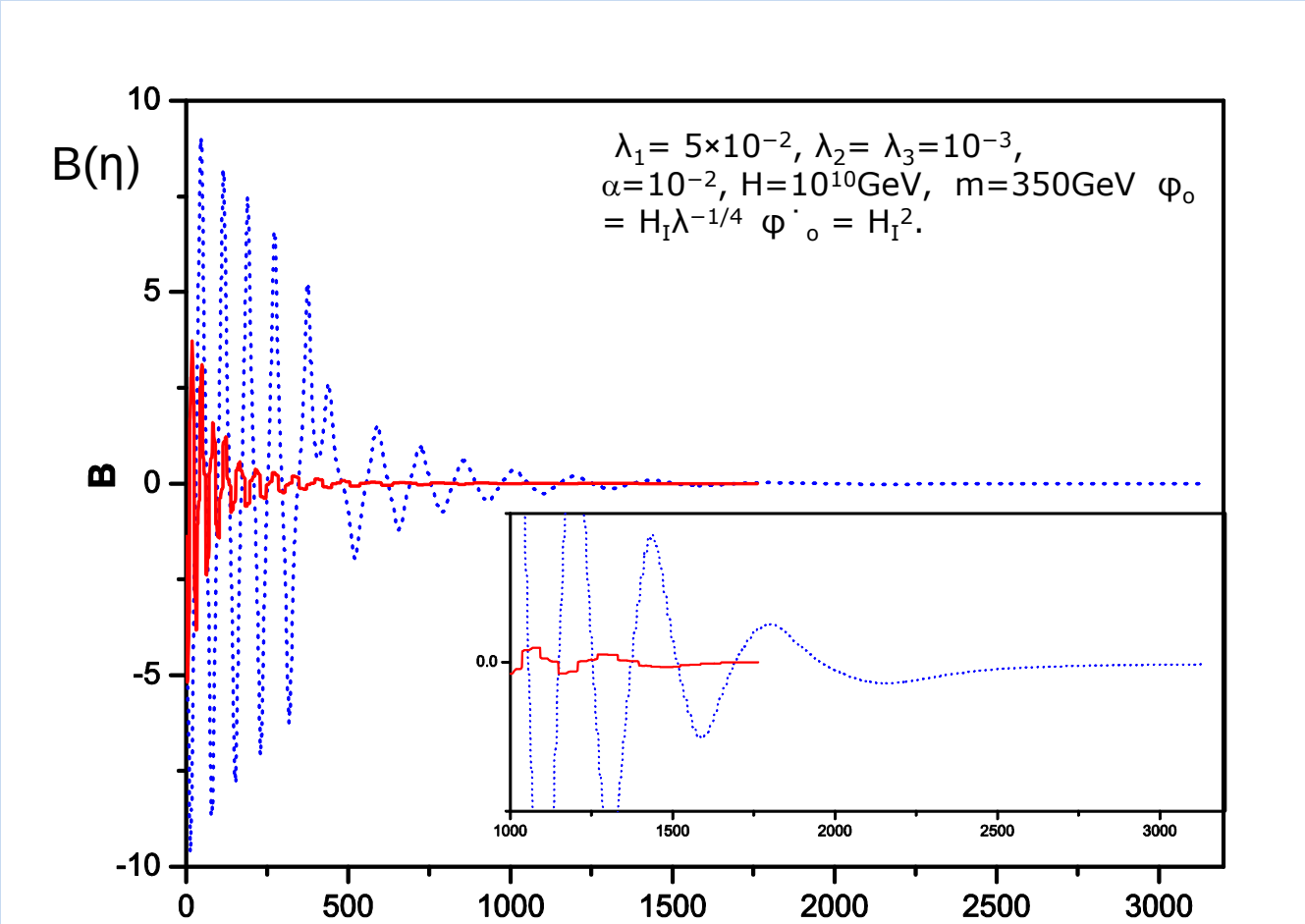
We have followed the evolution of B from inflation till BC epoch.

Numerical Analysis Results

For different λ, α, m and H_I, we have calculated $\varphi(t)$ and $B(t)$.

$\lambda = 10^{-2} \div 5\times10^{-2}$, $\alpha = 10^{-3} \div 5\times10^{-2}$, $H = 10^{7} \div 10^{12}$ GeV, $m = 100 \div 1000$ GeV

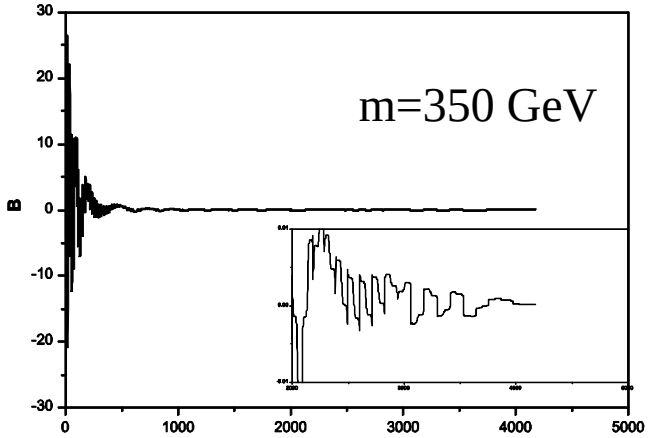
- Particle creation strongly reduces B.

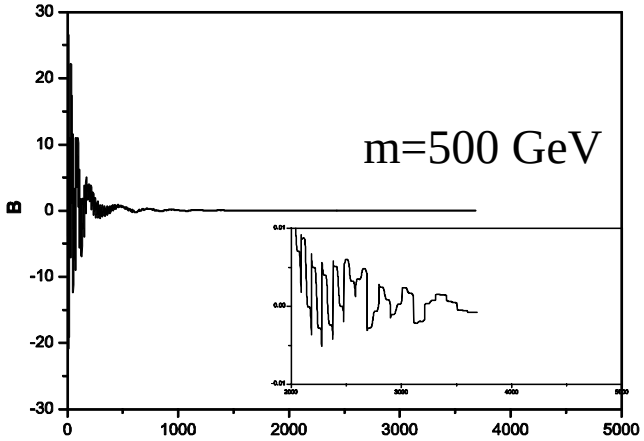


Results and Conclusions

The produced baryon charge decreases when m increases.

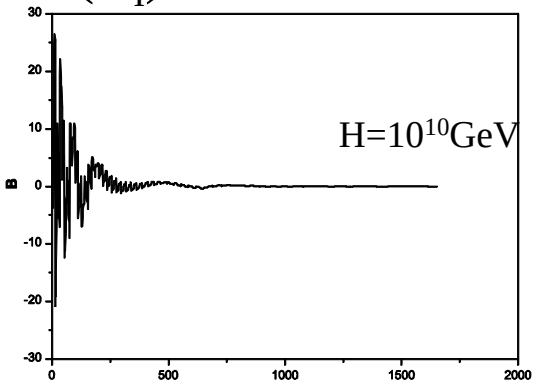
B(m)

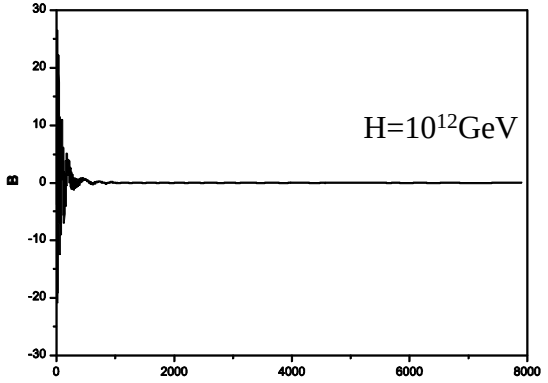




The produced baryon charge decreases when increasing H_I

$B(H_I)$





Conclusion

This SUSY-baryogenesis model is capable to explain simultaneously the observed local baryon asymmetry and to provide a natural separation mechanism of vast antimatter regions, eventually present in the Universe.