FiniteT

Hosotani solution for 2-flavor Schwinger model

In [1]:

```
γ = 0.5772156649 # Euler-Mascheroni constant
```

In [2]:

```
# input parameters:
β = 4.0
L = 20 # N_t
```

$$\mu = \sqrt{\frac{2}{\pi \beta}}$$

In [3]:

```
μ = n(sqrt(2 / (pi * β))) # eta-mass
g = 1.0 / sqrt(β)
```

In [4]:

```
μ
```

Out[4]:

```
0.398942280401433
```

In [5]:

```
g
```

Out[5]:

```
0.500000000000000
```

In [6]:

```
μ * L # this should be >> 1
```

Out[6]:

```
7.97884560802865
```

Pion mass

In [7]:

```
b = 1.0 / (2.0 * L * sqrt(μ * L)) # solution is valid for m << than this number
```

In [8]:

```
b
```

Out[8]:

```
0.00885054425344672
```

In [9]:

```
k = n(4 * sqrt(2) * sqrt(μ * L * exp(γ) / (4 * pi))) # slope for small m
```

In [10]:

```
k
```

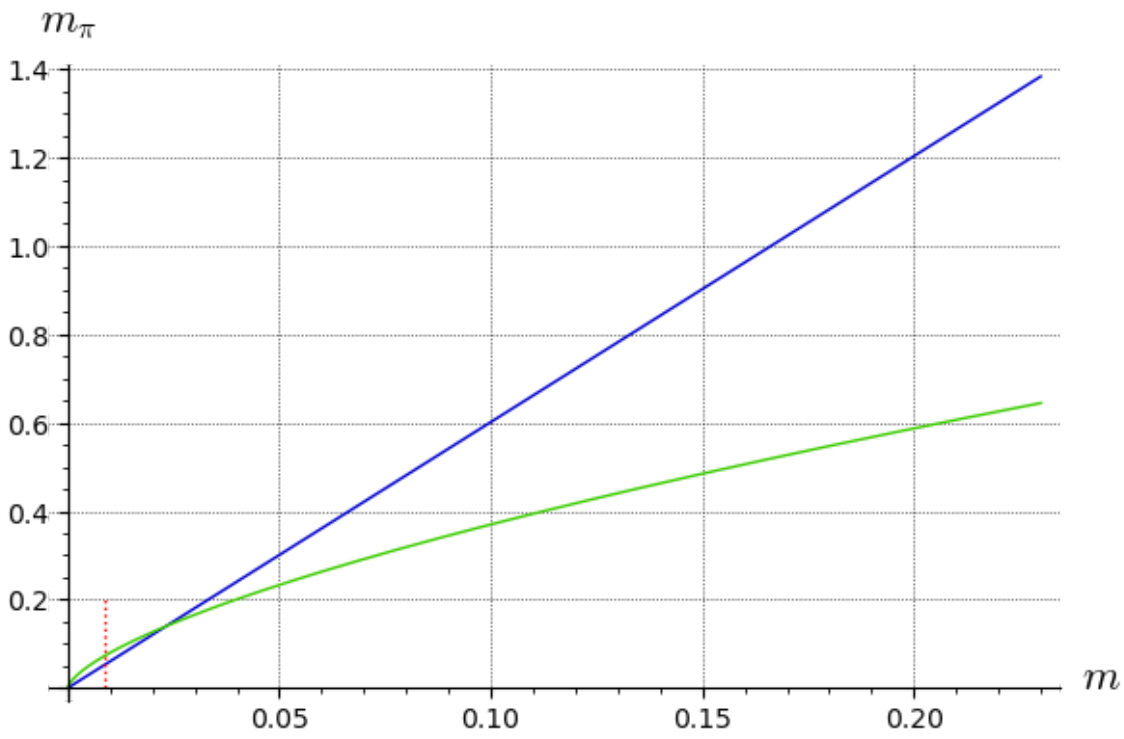
Out[10]:

```
6.01562668203976
```

In [11]:

```
var('m')
plot([k * m, (4 * exp(2 * γ) * μ * m^2)^(1/3)], 0.0001, 0.23,
  gridlines = True, axes_labels = [r"$m$", r"$m_\pi$"]) + line(
  [[b, 0], [b, 0.2]], linestyle = ":", color = 'red')
```

Out[11]:



Condensate $< \bar{\psi}\psi >$

In [12]:

```
b = 1.0 / (L * sqrt(μ * L)) # solution is valid for m << than this number
```

In [13]:

```
b
```

Out[13]:

0.0177010885068934

In [14]:

```
k = n(2 * exp(γ) * μ * L / pi^2) # slope for small m
```

In [15]:

```
k
```

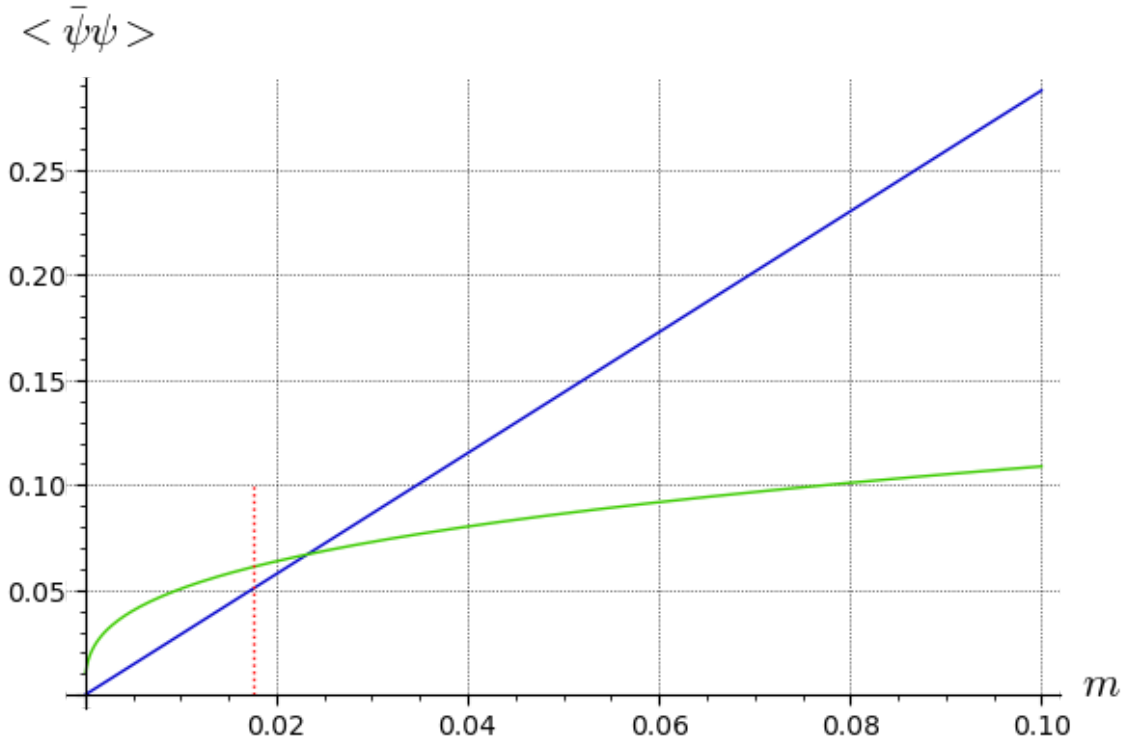
Out[15]:

2.87973079007539

In [16]:

```
var('m')
plot([k * m, (exp(4 * γ) * m * μ^2 / (4 * pi^3))^(1/3)],
  0.0001, 0.1, gridlines = True, axes_labels=[r'$m$', r'$<\bar{\psi}\psi>$']) + line(
  [[b, 0], [b, 0.1]], linestyle = ":", color = 'red')
```

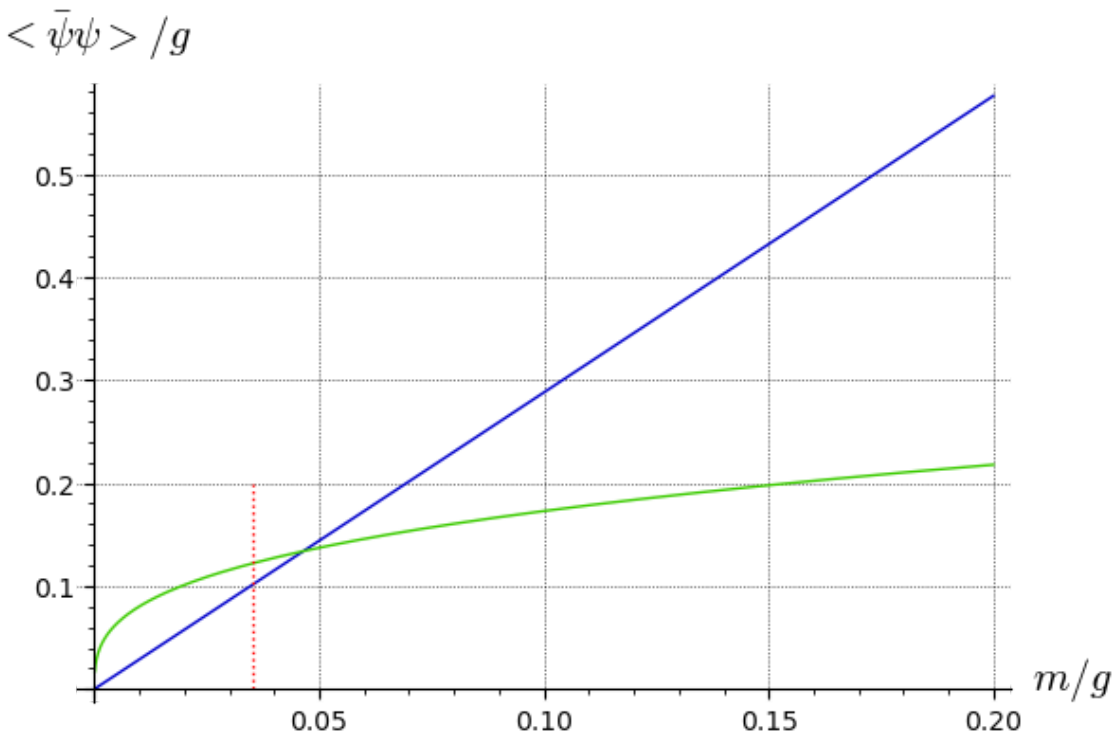
Out[16]:



In [17]:

```
var('x') # x = m / g  =>  m = x * g
plot([k * (x * g) / g, (exp(4 * γ) * (x * g) * μ^2 / (4 * pi^3))^(1/3) / g], 0.0001, 0.
1 / g,
  gridlines = True, axes_labels=[r'$m/g$', r'$<\bar{\psi}\psi>/g$']) + line(
  [[b / g, 0], [b / g, 0.1 / g]], linestyle = ":", color = 'red')
```

Out[17]:



Hip, 2021-08-21