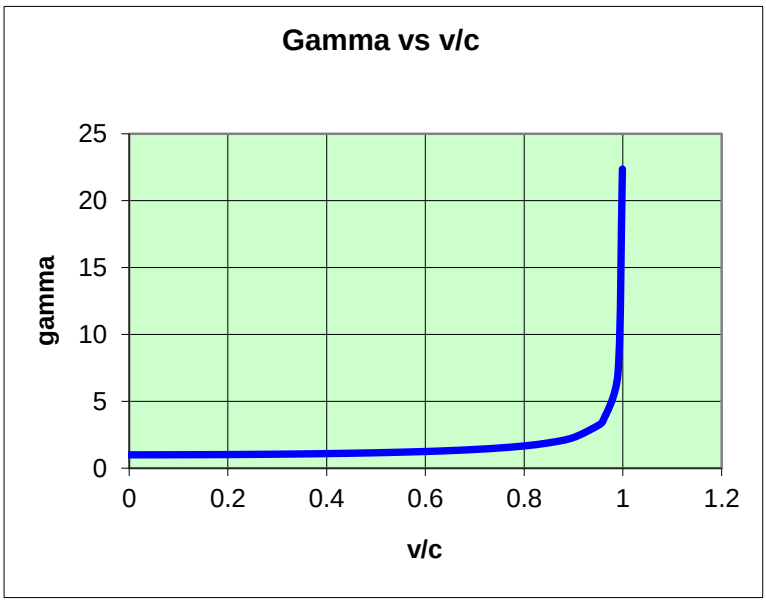
Computation of Complex Gamma in Special Relativity
Wednesday, 02 January 2002

In special relativity Gamma, γ, is defined as

$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}},$$

v is the velocity of an object and
c is the velocity of light.
Normally we say $0 \le v/c \le 1$.
In this case, γ is,



$\gamma \Rightarrow \infty$ as $v \Rightarrow c$.

Various things can happen as follows,

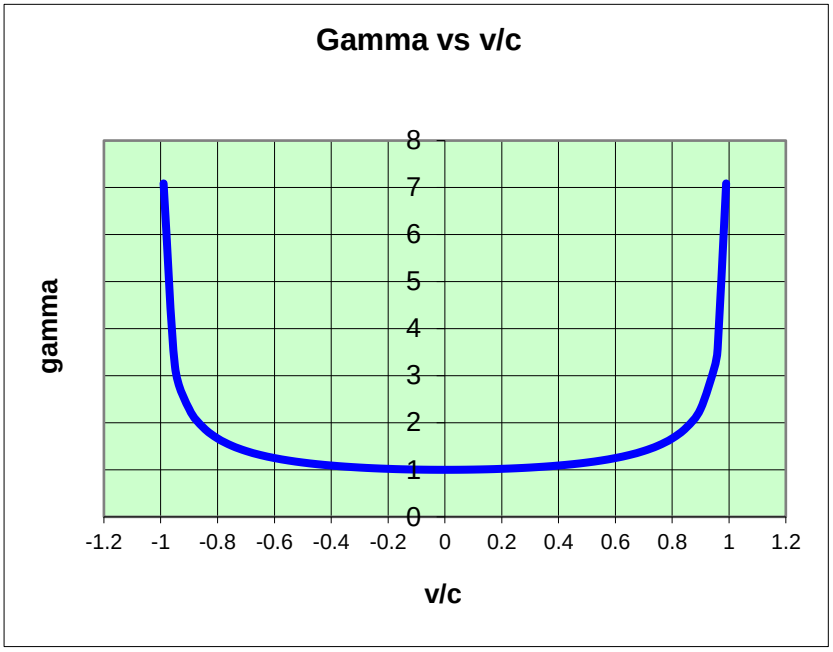
Lorentz Contraction. A meter length gets relatively shorter when moving e.g. becomes 0.5m.
$l = l_0/\gamma$, as $v \to c$ then $\gamma \to \infty$ and $l \to 0$.
Here l is its length as seen by the observer at rest. l_0 is its length when not moving.
According to the metre rod itself it still has a length of l_0 when moving. It is only the observer who sees (can measure) its length shortened to l.
When $v = c$ then $l = 0$ i.e. object doesn't have a length in that direction for all intents and purpose it doesn't exist.

Time Dilation. To the observer a second gets relatively longer when the clock is moving e.g. it becomes 5 seconds.
$t = \gamma t_0$, as $v \to c$ then $\gamma \to \infty$ and $t \to \infty$.
When $v = c$ then $t = \infty$ i.e. object doesn't appear to move - it is frozen in time.

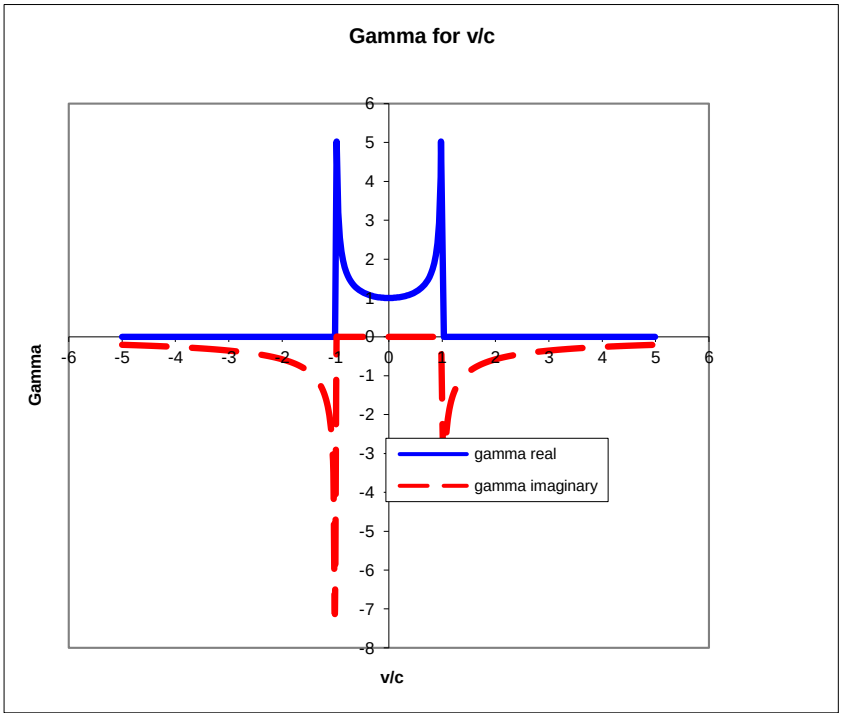
Mass Increase. A kilogram gets relatively heavier when moving e.g. becomes 5 kilograms.
$m = \gamma \, \mathrm{m}_0$, as $v \to c$ then $\gamma \to \infty$ and $m \to \infty$.

Gamma for Real v

Mathematically, γ can be defined for $-1 \le v/c \le 1.$
as shown below,



Extending this, γ can also be defined mathematically over the range $-\infty \le v/c \le \infty$.
In this case γ becomes complex, whatever that means for the things above i.e. length contraction, time dilation, mass increase.
In fact for $(v/c) < -1 \text{ and } (v/c) > 1$ γ is imaginary as following graph shows,



Complex v

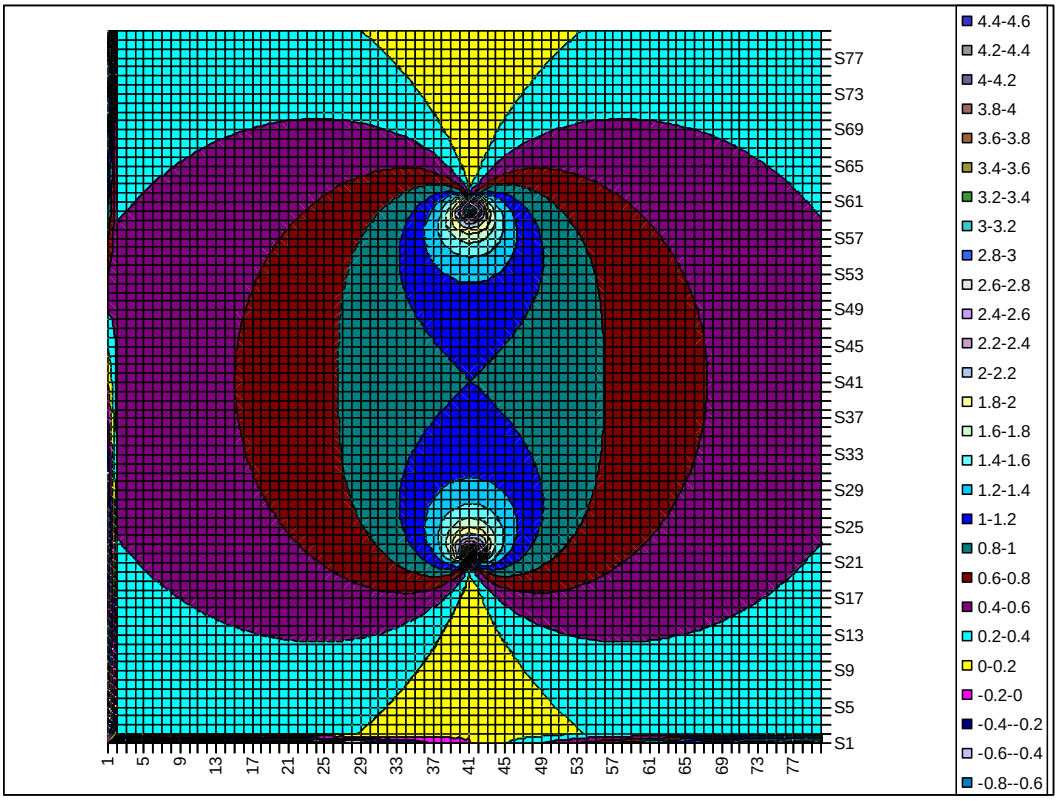
Consider mathematically the value of gamma for complex velocity, v, forgetting what this means physically.

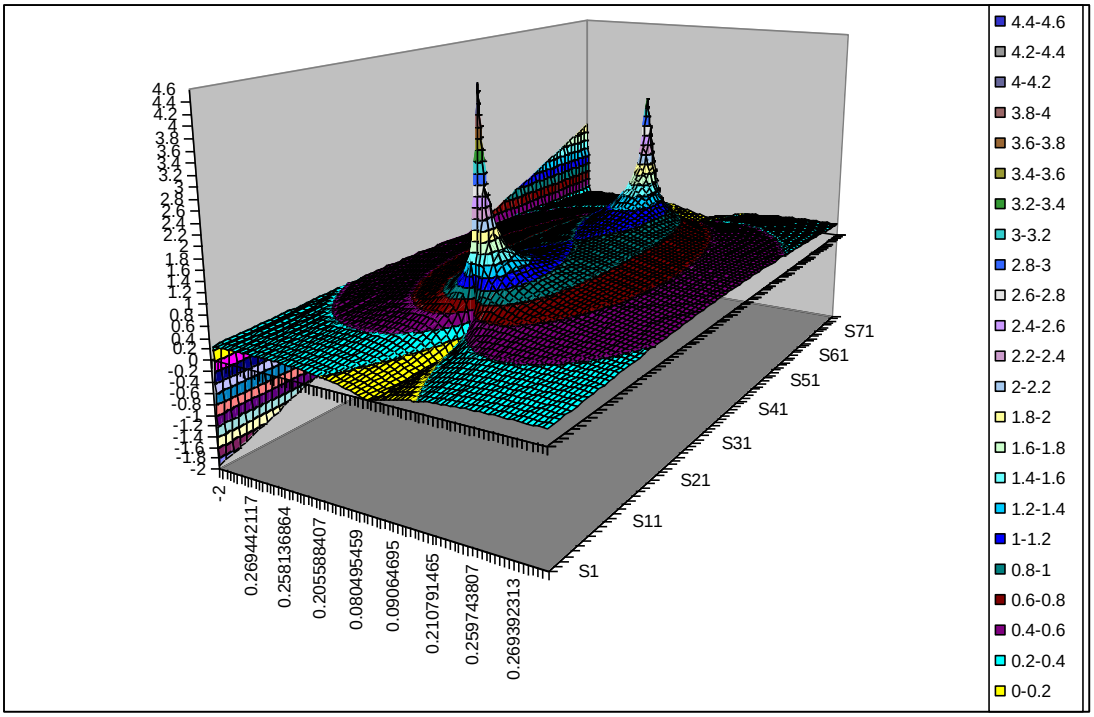
$\therefore v = v_r + iv_i$

and, $\gamma = \gamma_r + i\gamma = \dfrac{1}{\sqrt{1-(v_r + iv_i)^2 / c^2}}$

Real Gamma for v complex

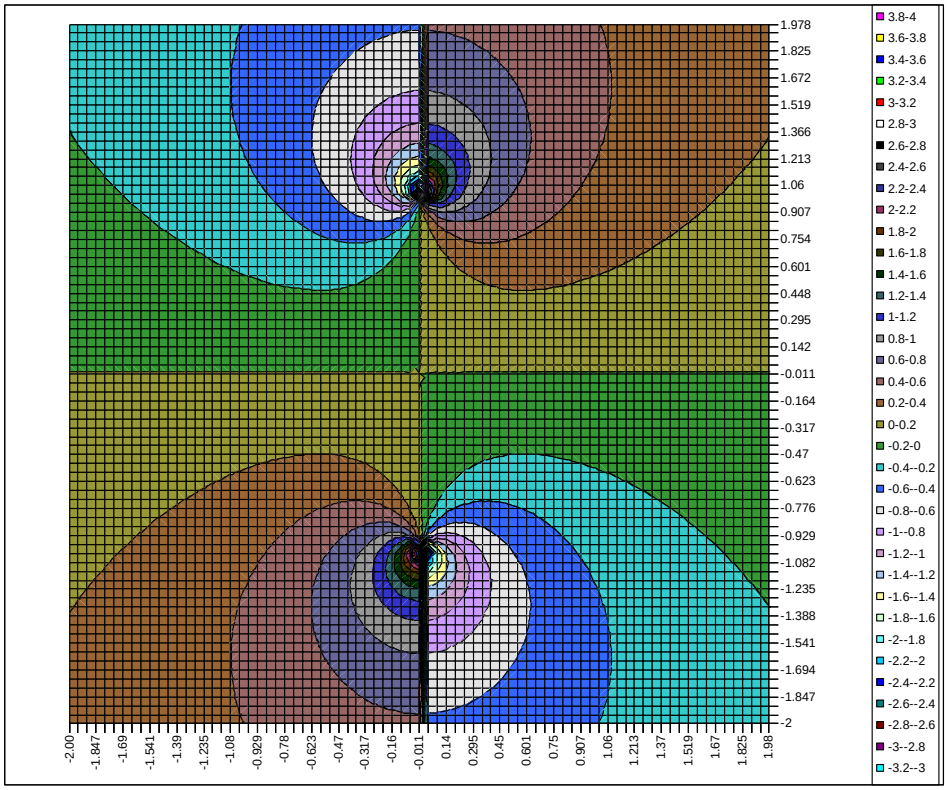
γ_r is given in the following graphs

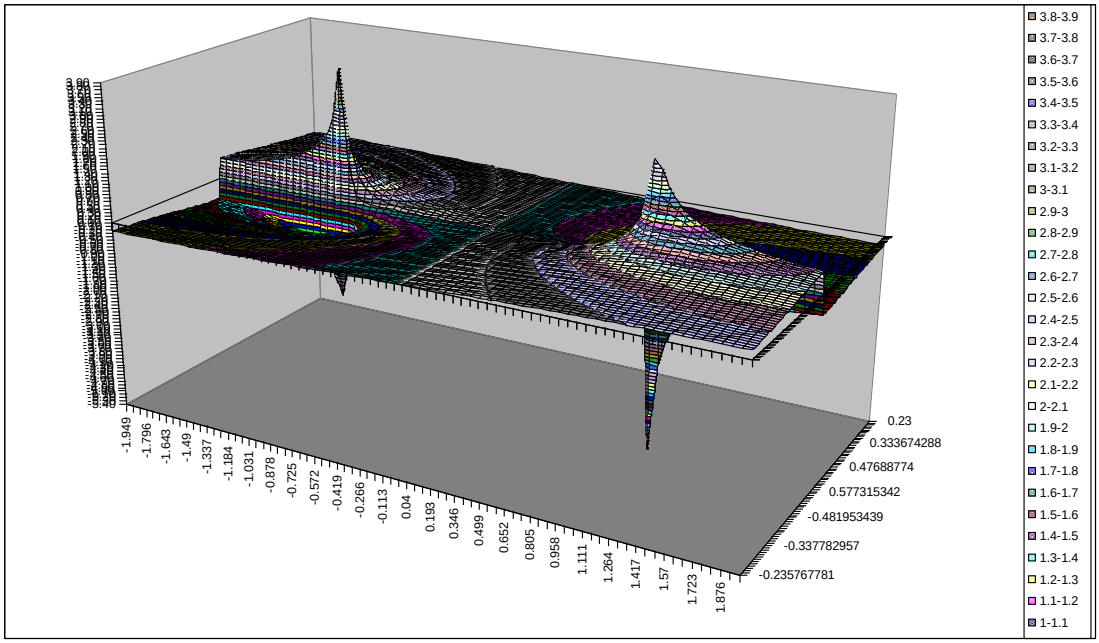




Imaginary Gamma for v complex

γ_i is given in the following graphs.





These look like dipole fields i.e N and south magnetic pole and north and north pole or electrically + and – charge of attraction or + + charge for repulsion. i.e dipole attraction is produced from the real gamma for complex velocity and dipole repulsion is imaginary gamma for complex velocity.

Ties up with particle – wave real – complex components.
A complexon is a generic term which can exhibit wave or particle behaviour depending on the observance of real or imaginary parts of the motion of the vacuum.

Mass- solid energy
Electromagnetic waves – liquid energy
Vacuum – gaseous energy.

As temperature increases goes from M-E-V change of state.