A quantal Tolman temperature

Yongwan Gim
(Sogang University, Korea)

collaborated with Wontae Kim
and based on arxiv : 1508.00312

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which is a local temperature detected by the free fall observer at the finite distance from the black hole in the thermal equilibrium state.

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Perfect fluid	$T^{\mu\nu} = (\rho + p)u^\mu u^\nu + pg^{\mu\nu}$	
The first law	$dU = TdS - pdV$	
Trace anomaly	$T^\mu_\mu = 0$	
Stefan-Boltzmann law	$\rho = \gamma T^2$ $p = \gamma T^2$	
Proper temperature	$T = \frac{C_0}{\sqrt{\gamma f(r)}}$ $\frac{C_0}{\sqrt{\gamma}}$: Hawking temperature	

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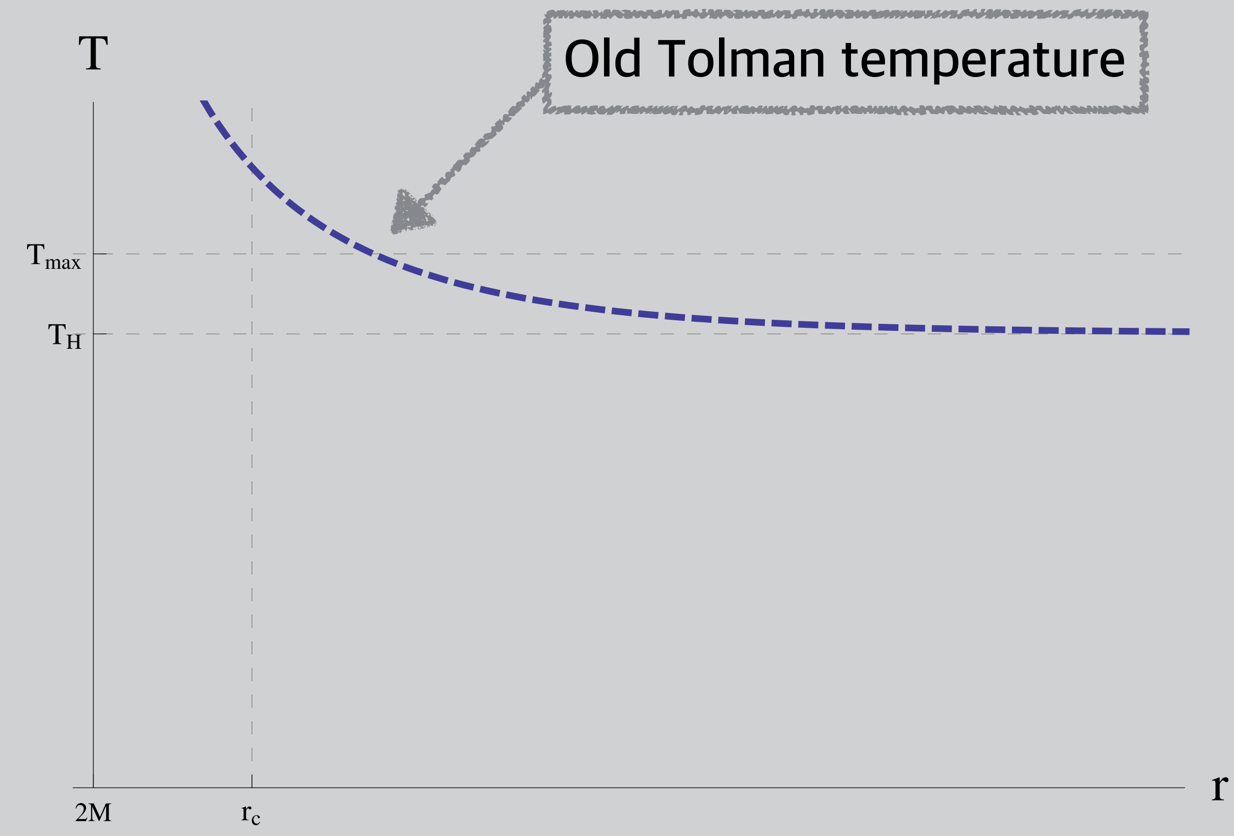
Graph		

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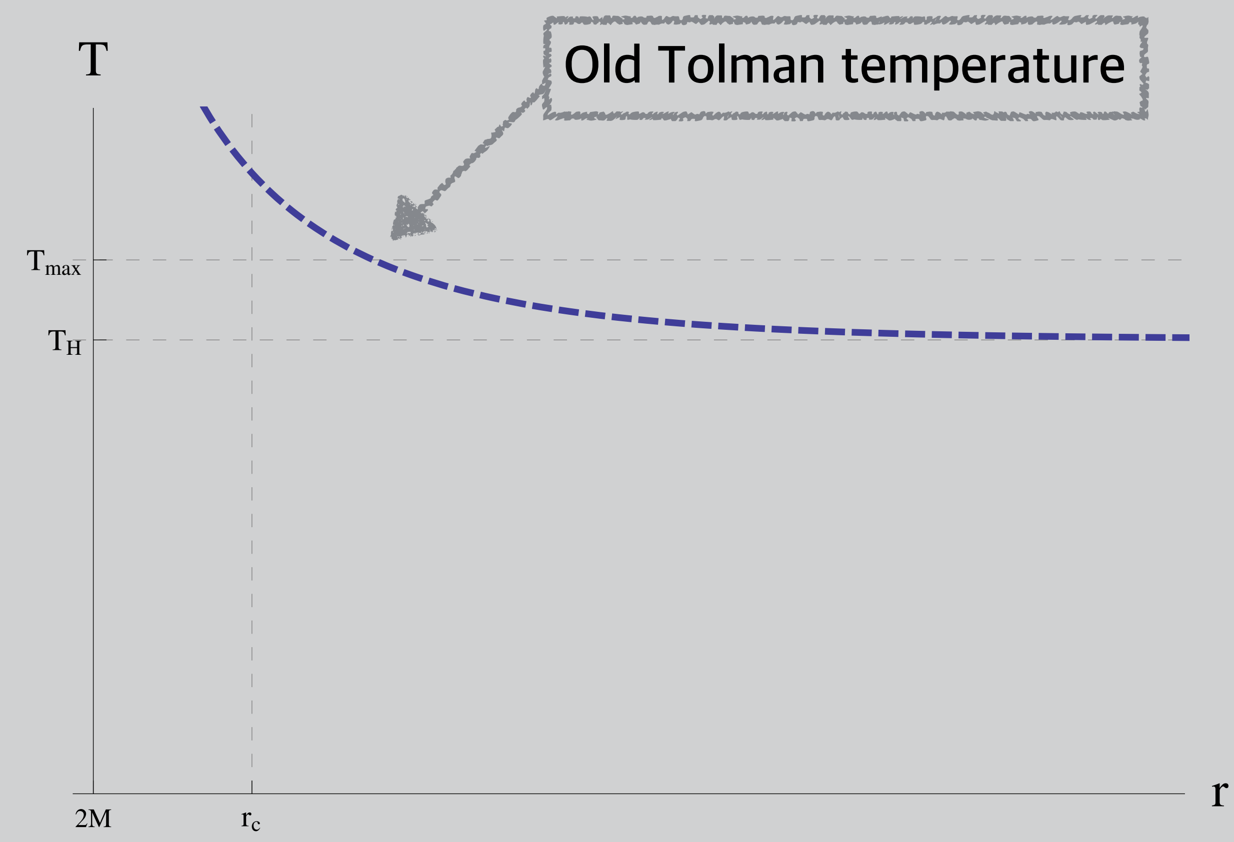
Graph		

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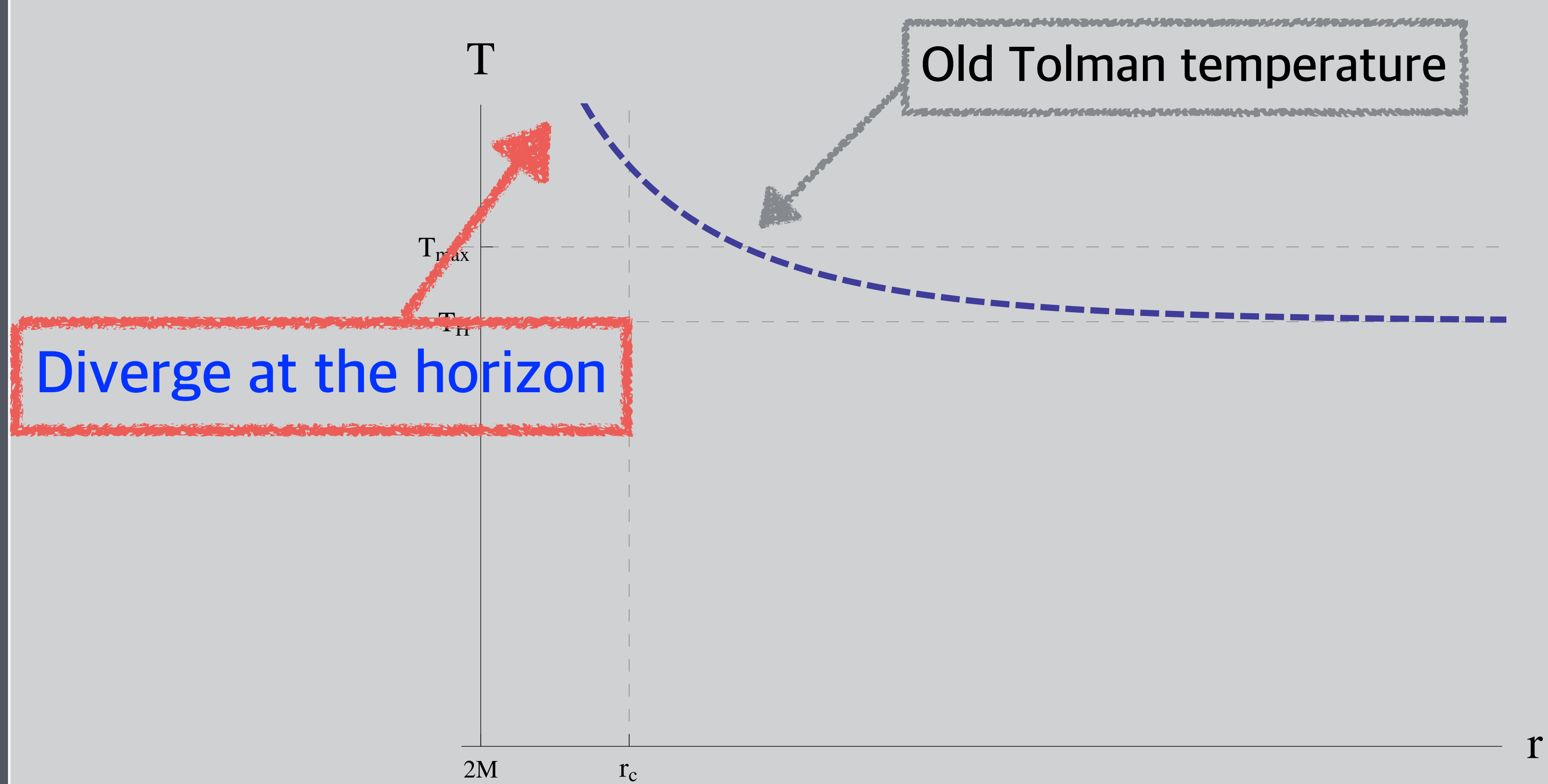
Graph		

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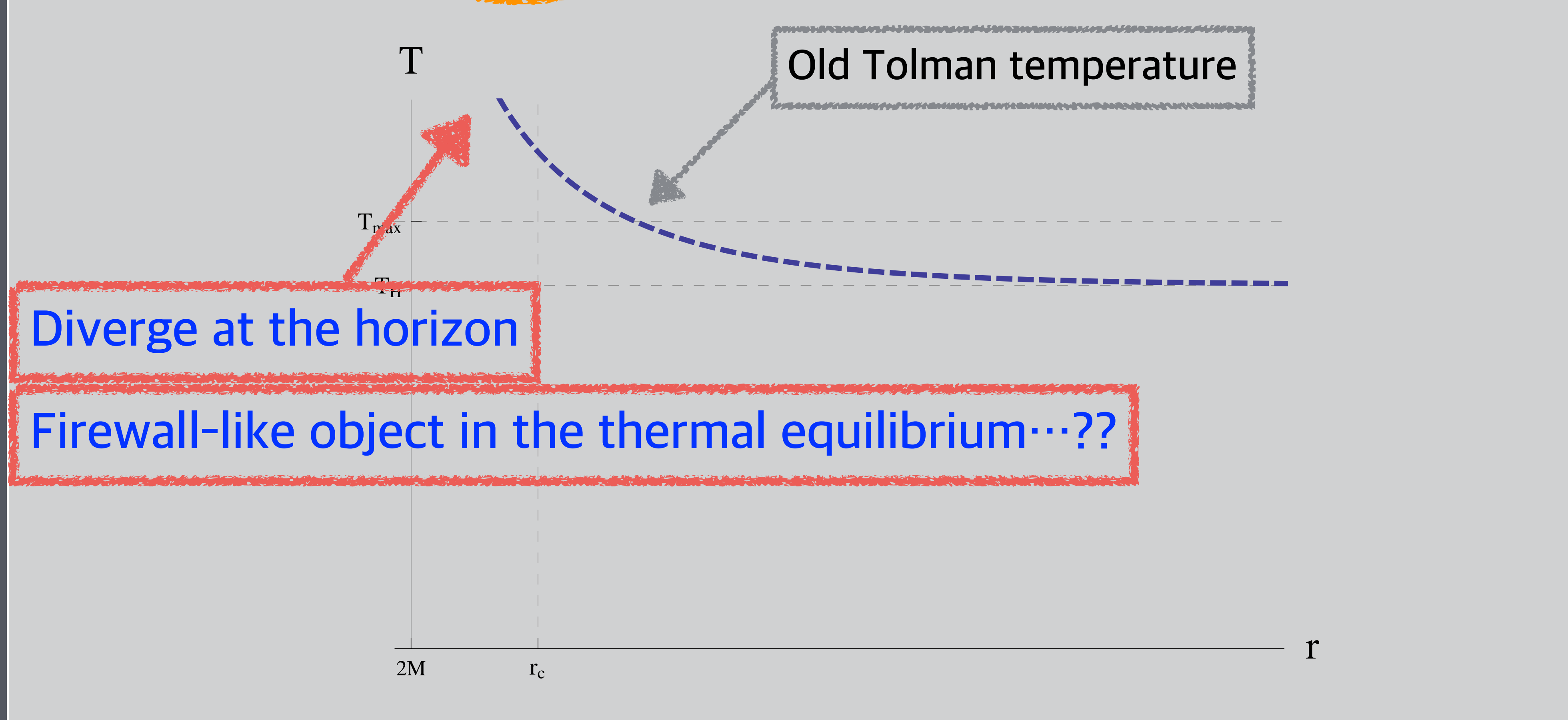

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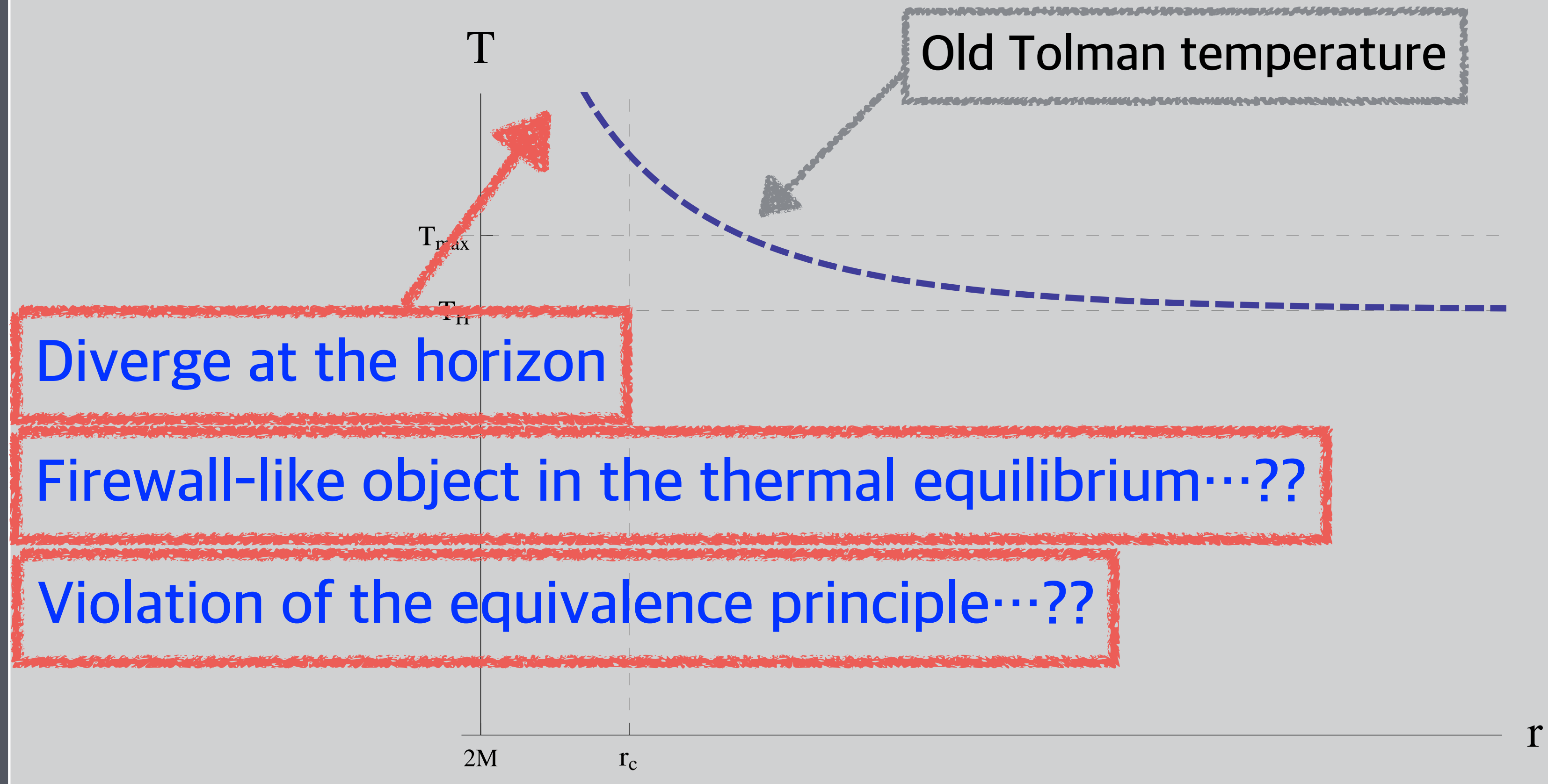
Graph		

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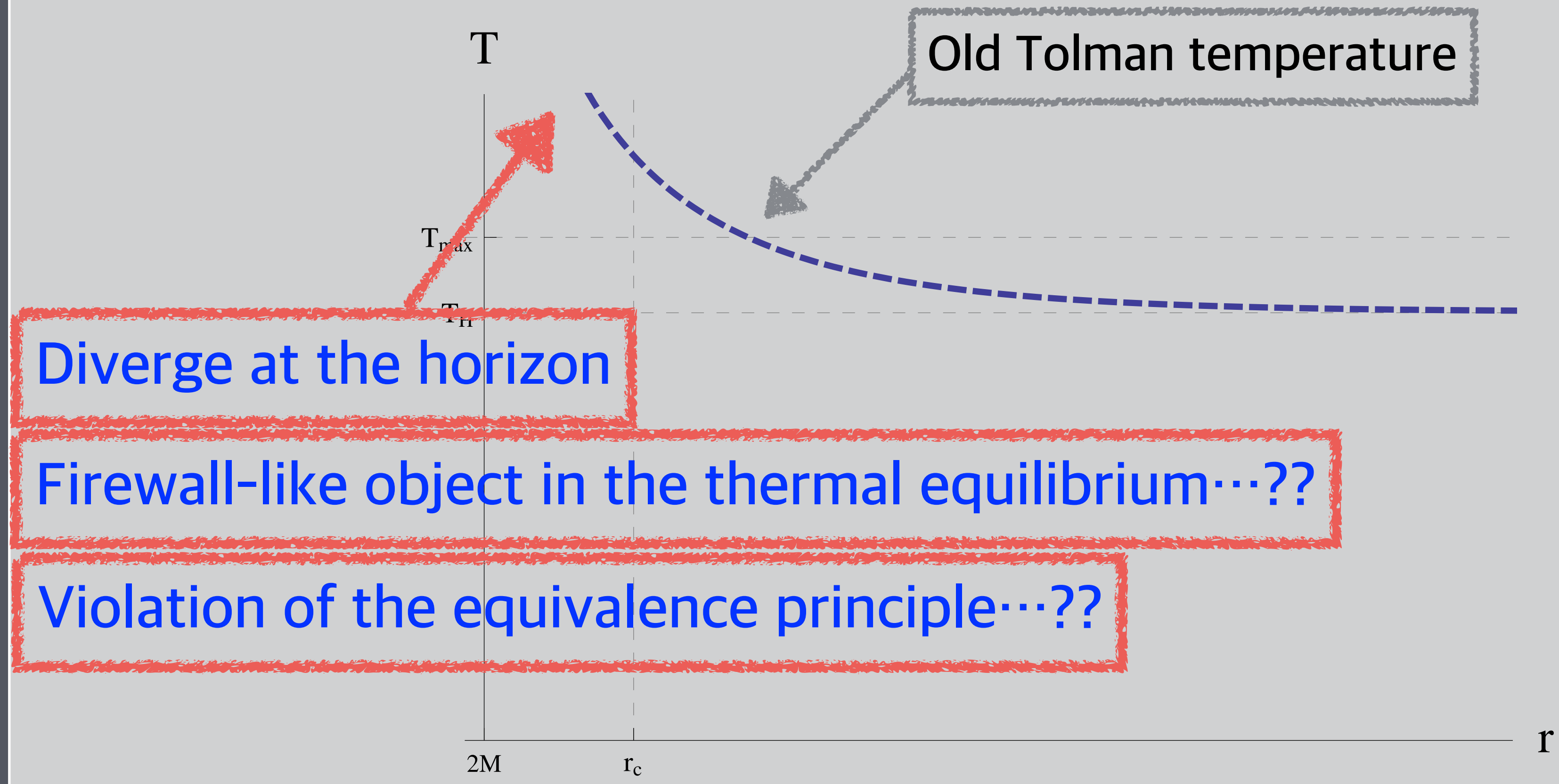
Graph		

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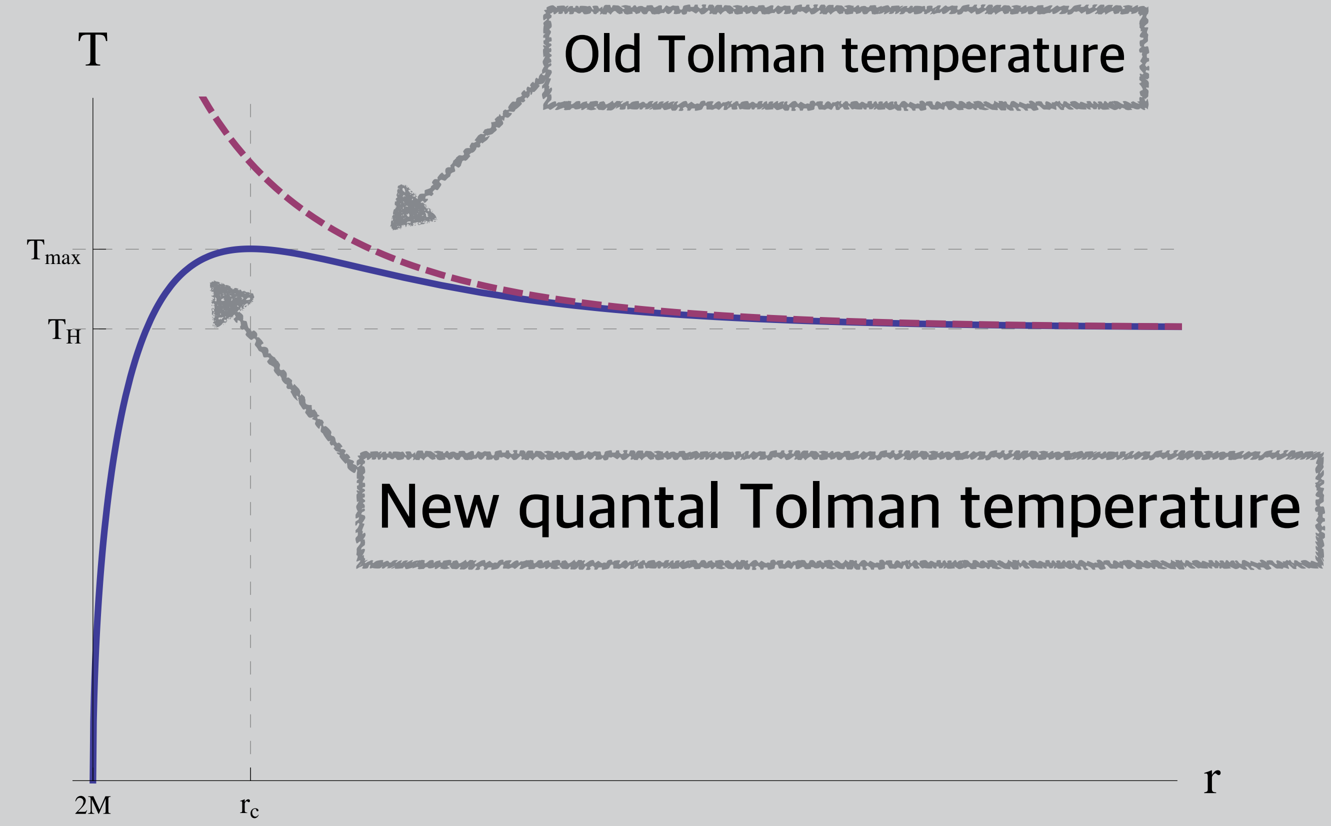
<tr><td>Graph</td><td colspan="2">
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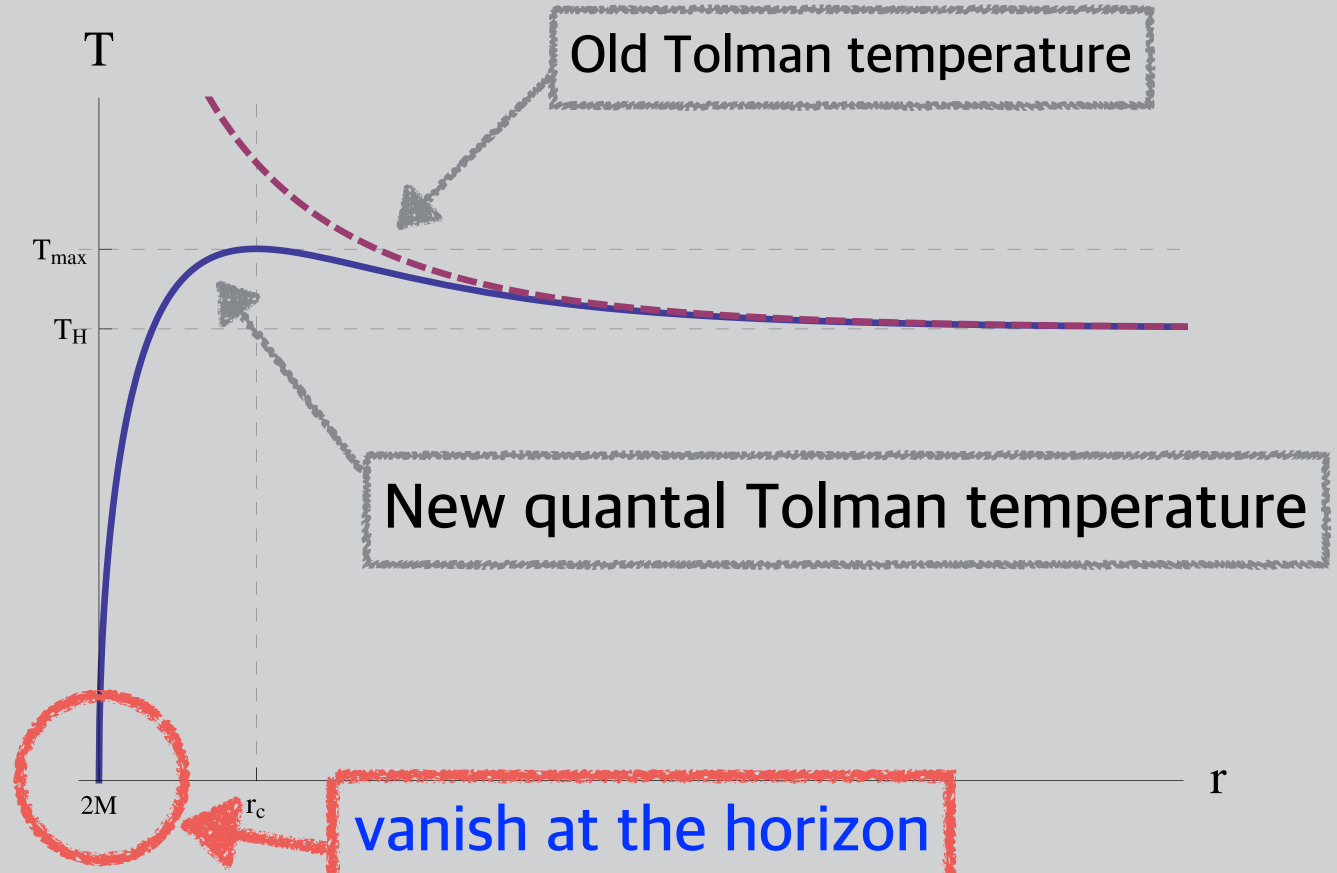
Graph	 	

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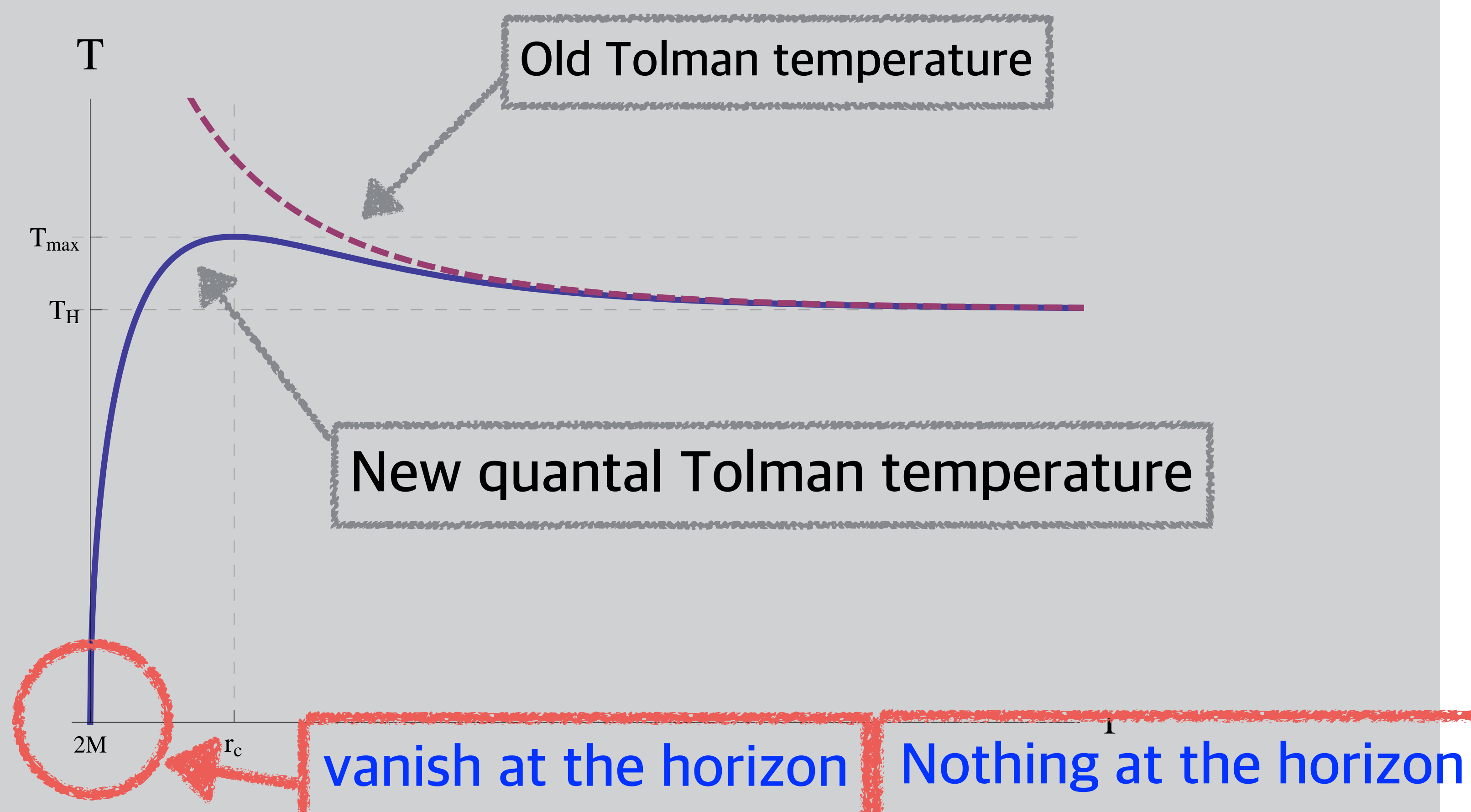
Graph		

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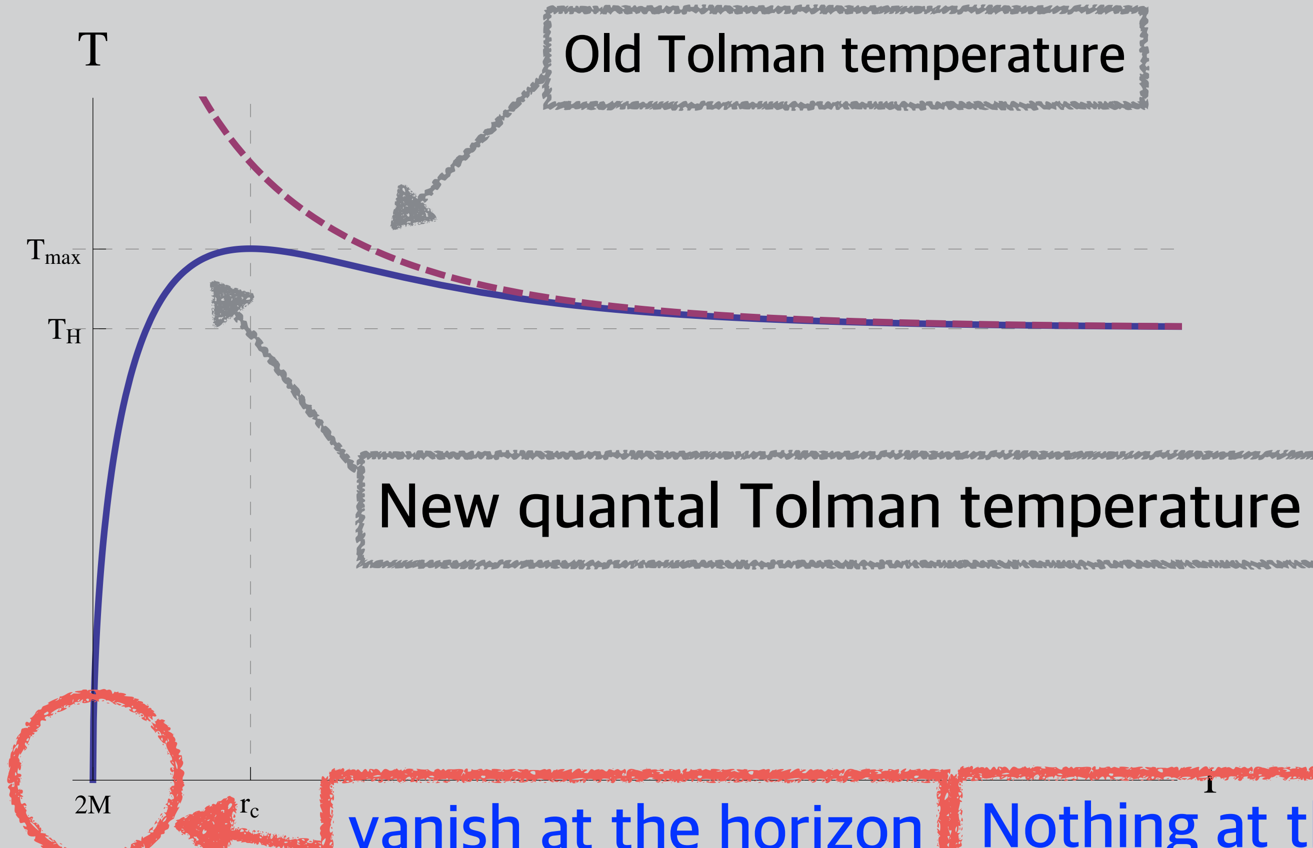

vanish at the horizon

Nothing at the horizon

Equivalence principle is recovered.

Conclusions and Discussions	
Modified Stefan-Boltzmann law	$\rho = \gamma T^2 - \frac{1}{2} T^\mu_\mu \qquad p = \gamma T^2 + \frac{1}{2} T^\mu_\mu$
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Thank you for your attention!!