Transformers

Notes on various aspects of Transfomers.

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1 To-Do List

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2 Non-Equilibirium EFTs

We review here the general formalism for studying non-equilibrium effective field theories (EFTs) in the manner proposed in [1].

2.1 Rough Outline

A rough outline of the physical picture is as follows:

- In generic out-of-vacuum systems, things are messy. In particular, fluctuations create and destroy quantities not protected by conservation laws.
- E.g., in a finite-T bath there is a characteristic relaxation time τ (and length ℓ) after which a generic fluctuation gets re-absorbed by the bath.
- At low energies, we only expect a handful of degrees of freedom to be relevant and long-lived (compared to τ, e.g.), primarily (but not exclusively) those protected by conservation laws.
- Local fluctuations of fields related to conserved quantities (like charges) cannot be absorbed, but only transported. For such quantities, the transport mechanism typically takes a time $t_\lambda \gg \tau$ to return the system to equilibrium for a fluctuation of wavelength $\lambda \gg \ell$ (this double limit is also the typical regime studied in hydro). These fluctuations are the interesting ones and are called the *slow variables*.
- In special situations, like near critical points, other *slow variables* can also emerge, but these are non-generic.

In [1], our primary source, the EFT structure describing systems of the above type is explained.

```
def hello_world(args):
  print("hello world this is a test")
```

References

[1] H. Liu and P. Glorioso, "Lectures on non-equilibrium effective field theories and fluctuating hydrodynamics," *PoS* **TASI2017** (2018) 008, arXiv:1805.09331 [hep-th]. 1