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## **Non-equilibrium field theory and decay widths: a new golden rule**

Motivated by magnetic quantum systems in the regime of finite temperatures and close vicinity to a quantum critical point, we develop a generalisation of the Fermi Golden Rule appropriate to handle the calculation of large decay widths. The ‘generalised golden rule’ is a self-consistent procedure, and the central results are generic. However, the present study specifically considers an  $O(3)$  non-linear field theory;  $\bar{\varphi}^4$  theory, as a toy application of the generalised golden rule. Following this, we directly apply our results to the real quantum antiferromagnet  $\text{TiCuCl}_3$ , which is very well described by the  $O(3)$  field theory with an anisotropic term. We compare our results to the very recent INS data and find excellent agreement.

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