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Quantum catastrophes

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Caustics are singularities arising from wave focusing. Examples include rainbows, gravitational lensing, and freak waves. The natural mathematical language for describing caustics is catastrophe theory which predicts that caustics take on certain universal shapes. When applied to classical waves one finds that the singularities seen at large scales are replaced at short scales by smooth universal interference patterns that obey a remarkable set of scaling relations. My group has been extending these ideas to quantum fields such as those that occur in spin chains, Bose-Einstein condensates, and in waves near event horizons. While in some cases we get discretised versions of the classical wave catastrophes, we also find new types of catastrophe associated with particle production.

Keyword-1

quantum dynamics

Keyword-2

analogue black holes

Keyword-3

Bose-Einstein condensates

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