

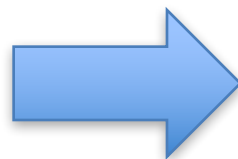
接触型相互作用する1次元ボース気体 およびフェルミ気体の相関関数

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Ultracold atomic gas:

Feshbach resonance
+
Optical lattice



1D quantum gas
near a resonance

Controllable scattering length a
(coupling constant)

	1D Bose gas near a s-wave resonance	1D Fermi gas near a p-wave resonance
Scattering length	a_B	a_F
Contact	$C_B \sim \left(\frac{\partial F}{\partial(1/a_B)} \right)_{T,\mu}$	$C_F \sim \left(\frac{\partial F}{\partial(1/a_F)} \right)_{T,\mu}$

Our goal: *Universal relations for the 1D gases*

Resonant interaction



Universal relations,
which hold for ***any*** $a_{B/F}, T, \mu$!!

e.g. Large momentum tails of momentum distributions

Bose gas

$$\rho_B(k) \xrightarrow{|k| \rightarrow \infty} \frac{4C_B}{a_B^2 k^4}$$

Fermi gas

$$\rho_F(k) \xrightarrow{|k| \rightarrow \infty} \frac{4C_F}{k^2}$$

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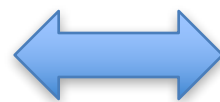
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Correlation function



Thermodynamics

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Thermodynamics

Universal relations



Specialty of 1D

1. *Bose-Fermi Correspondence*
2. *Quantum Integrability*